

# IC-740

## HF ALL BAND TRANSCEIVER

### INSTRUCTION MANUAL



**ICOM**

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## SECTION 1 SPECIFICATIONS

### GENERAL

#### Number of Semiconductors:

Transistors	85
FET	18
IC (Includes CPU)	48
Diodes	247

#### Frequency Coverage:

1.8MHz ~ 2.0 MHz  
3.5MHz ~ 4.0 MHz  
7.0MHz ~ 7.3 MHz  
10.0MHz ~ 10.5 MHz  
14.0MHz ~ 14.35MHz  
18.0MHz ~ 18.5 MHz (Receive Only)  
21.0MHz ~ 21.45MHz  
24.5MHz ~ 25.0 MHz (Receive Only)  
28.0MHz ~ 29.7 MHz

#### Frequency Control:

CPU based 10Hz step PLL synthesizer.  
Independent Transmit-Receive Frequency Available on same band.

#### Frequency Readout:

6 digit 100Hz readout.

#### Frequency Stability:

Less than 500Hz after switch on 1 min to 60 mins, and less than 100Hz after 1 hour. Less than 1KHz in the range of -10°C to +60°C.

#### Power Supply Requirements:

DC 13.8V ±15% Negative ground Current drain 20A max. (at 200W input)  
AC power supply is available for AC operation.

#### Antenna Impedance:

50 ohms Unbalanced

#### Weight:

8.0 Kg

#### Dimensions:

111mm(H) x 286mm (W) x 374mm(D)

### TRANSMITTER

#### RF Power:

SSB (A<sub>3</sub>J) 200 Watts PEP input  
CW (A<sub>1</sub>), RTTY (F<sub>1</sub>), FM (F<sub>3</sub>)<sup>\*</sup>  
200 Watts input

Continuously Adjustable Output power 10 Watts ~ Max.

#### Emission Mode:

A<sub>3</sub>J SSB (Upper sideband and Lower sideband)  
A<sub>1</sub> CW  
F<sub>1</sub> RTTY (FSK)  
F<sub>3</sub>\* FM

<sup>\*</sup>When optional FM unit is installed.

#### Harmonic Output:

More than 50dB below peak power output

#### Spurious Output:

More than 50dB below peak power output

#### Carrier Suppression:

More than 50dB below peak power output

#### Unwanted Sideband:

More than 55dB down at 1000Hz AF input

#### Microphone:

Impedance 1300 ohms

Input Level 120 millivolts typical

Dynamic or Electret Condenser Microphone with Preamplifier

### RECEIVER

#### Receiving System:

Triple Conversion Superheterodyne with continuous Pass-Band Shift Control.

#### Receiving Mode:

A<sub>1</sub>, A<sub>3</sub>J (USB, LSB), F<sub>1</sub>, F<sub>3</sub>\*

#### IF Frequencies:

1st 39.7315MHz

2nd 9.0115MHz

3rd 455KHz

with continuous Pass-Band Shift Control.

#### Sensitivity:

SSB, CW, RTTY

Less than 0.3 microvolts for 10dB S+N/N

(preamp ON)

Less than 0.15 microvolts for 10dB S+N/N

FM\* (preamp ON)

Less than 0.3µV for 20dB noise quieting

#### Selectivity:

SSB, RTTY 2.4KHz at -6dB

4.5KHz at -60dB

(PBT max.) 2.2KHz at -6dB

4.2KHz at -60dB

(PBT min) 700Hz at -6dB

2.0KHz at -60dB

CW (AF Filter) 300Hz at -6dB

FM\* 15KHz at -6dB

30KHz at -60dB

#### Spurious Response Rejection Ratio:

More than 60dB

#### Audio Output:

More than 2.6 Watts

#### Audio Output Impedance:

8 ohms

## SECTION 2 FEATURES

### ALL BAND, ALL MODE, ALL SOLID STATE

The IC-740 covers all the Amateur HF frequencies from 1.8MHz to 29.9999MHz, including the new three bands of 10MHz, 18MHz and 24MHz. It offers not only SSB, but also CW and RTTY (FM option). All of the circuits in the IC-740, including the driver and final power stages are completely solid state, and provide about 100 watts output.

In addition, the low-pass filters switched by the BAND switch and the band-pass filters selected by an electronic signal from the CPU, make a no tune-up system.

### OUTSTANDING RECEIVER PERFORMANCE

The IC-740 employs the ICOM DFM (Direct Feed Mixer) system and up-conversion system to improve a high receiver performance.

The ICOM DFM maintains a system where the incoming signals are directly fed to the first mixer, and the mixer is a high level Doubly Balanced Mixer developed exclusively by ICOM.

The up-conversion system uses a high side IF i.e., 39.7315MHz and in addition high performance third over-tone crystal filters provide excellent image and IF rejection ratio.

These advanced devices and system give higher spurious response rejection ratio, higher sensitivity and wider dynamic range.

### PASS BAND SHIFT CONTROL

The IC-740 has a built-in Pass Band Shift system that allows you to continuously adjust the center frequency of the IF pass-band. By moving the control, you can eliminate interference from a nearby signal, thus providing clear reception. It can also be used as a tone control.

When the PBT switch is pushed in, this system acts as a pass-band tuning system that allows you to continuously adjust the pass-band up to 800Hz from the upper or lower side in SSB and CW. The PBT switch provides better performance to eliminate interference.

### DUAL DIGITAL VFO WITH VARIOUS STEPS

The dual digital VFO consists of three digital Phase-Locked-Loops which are controlled by the Microcomputer Control System.

Three tuning frequency resolutions of 10Hz, 100Hz and 1KHz steps can be selected with the TUNING RATE switches.

Two separate VFO's can be used independently in the NORMAL (NOR) operation, and any desired in-band frequencies split transmit/receive can be used in the SPLIT (SPT) operation.

### MEMORY CHANNELS

The IC-740 has a frequency memory for each band. Any in-band frequency of the VFO A can be stored into the memory, and it can be recalled at any time.

### ADDITIONAL CIRCUITS

The IC-740 has a built-in Noise Blanker, VOX, CW Monitor, APC, SWR detector, and many other circuits for your convenience.

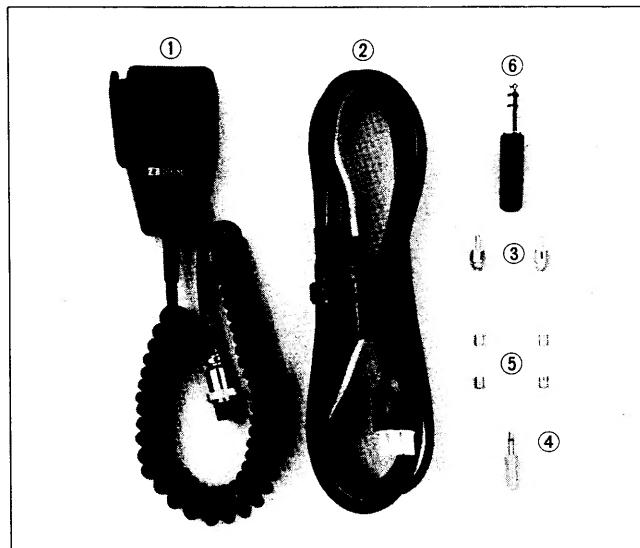
The IC-740 has everything you need to really enjoy HF operation, in an extremely compact, rugged and full featured transceiver.

## SECTION 3 INSTALLATION

BE SUARE TO READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE OPERATION

### 3 - 1 UNPACKING

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. Should any be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary they will be handy. Accessory cables, plugs, etc., are packed with the transceiver. Make sure you have not overlooked anything.



1. Microphone (IC-HM7) .....	1
2. DC Power Cord.....	1
3. Pin Plugs .....	2
4. External Speaker Plug .....	1
5. Spare Fuses (20 Amp) .....	2
6. 3-P Key Plug.....	1

### 3 - 2 RECOMMENDATIONS FOR INSTALLATION

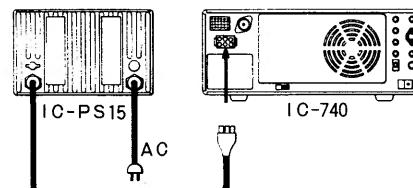
1. Avoid placing the IC-740 in direct sunlight, high temperature, dusty or humid places.
2. The temperature of the set will usually become relatively warm during transmission. Any equipment should be at least 1 inch (3cm) away from the unit so as to provide good ventilation. Be sure that nothing is on and just behind the rear PA heatsink to ensure good ventilation. Also avoid places near outlets of heaters, air conditioners etc.
3. Place the unit so that the controls and switches can easily be handled and the frequency indication and meter can easily be read.
4. For mobile installation, an optional mounting bracket is available. Select the best location that can stand the weight of the unit and that does not interfere with your driving in any way.
5. Use the Ground Lug!

### 3 - 3 POWER SUPPLY

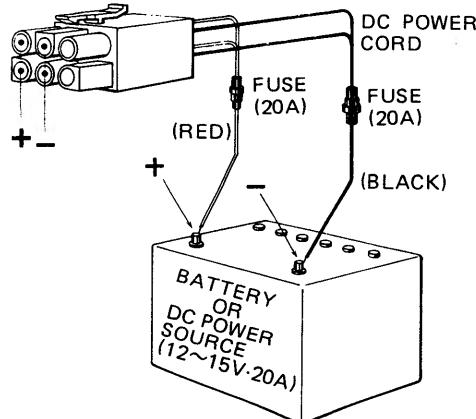
For AC operation, use the special power supply IC-PS15, or optional built-in power supply IC-PS740. If you would like to use your car battery or any other DC power supply, be sure that its output voltage is 12-15 Volts and the current capacity is at least 20 Amps. The maximum power consumption of the set during transmission runs from 16-20 Amps, so keep that in mind if the unit is installed in your automobile, and turn it on after you have started the engine. Attention should also be paid to the condition of the battery and electrical system.

The connection of the DC power cord supplied with the IC-740 is done in the following way: First make sure that the power switch of the unit is in the OFF position and the T/R switch is in the receive position. Connect the cord to the DC power supply with the RED lead to the positive terminal and the BLACK lead to the negative terminal. (Reverse connection will cause the protection circuit to operate and blow the fuse.) Connect the DC plug to the socket on the rear panel of the IC-740. Refer to the drawing below.

#### For AC operation



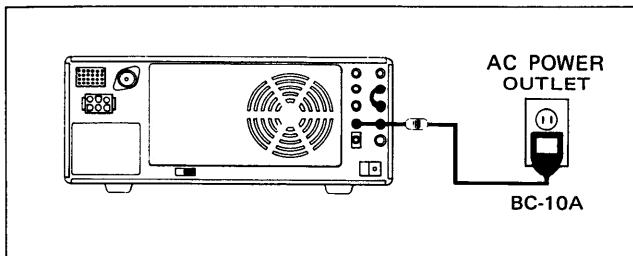
#### For DC operation



### 3 - 4 MEMORY BACK-UP

To retain the memory in the CPU, keeping the operating frequencies of the VFOs even when the main Power Switch is turned OFF, connect a power source of 9 to 12 Volts DC to the Memory Back-Up terminal on the rear panel. For mobile installation this can be accomplished by direct connection to the car battery, since the current drain is low.

For AC operation it is recommended that the optional BC-10A be used.



### 3 - 5 ANTENNA

Antennas play a very important role in radio communication. If the antenna is inferior, your transceiver cannot give you the best performance. With a good antenna and feeder cable having 50 ohm impedance, you should easily get the desired matching and performance. Carefully install a high performance antenna that suits the frequency band(s) you wish to operate on and place it as high as possible. Be especially carefull of the condition of the connectors as loose connections will deteriorate the performance. Be sure to connect the ground terminal of a whip antenna, if used, to the body of your car.

As the output is quite high avoid connecting the antenna connector to open lines and do not transmit under mismatched conditions. Otherwise the final stage could be overloaded and cause a malfunction of the unit.

### 3 - 6 GROUND

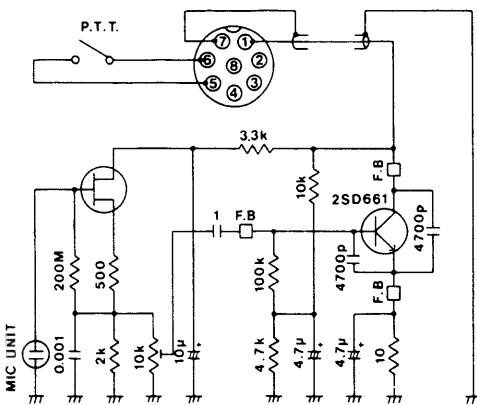
In order to prevent electrical shocks, TVI, BCI and other problems, be sure to connect a heavy wire ground, as short as possible, from a good earth point to the ground terminal on the rear panel.

### 3 - 7 MICROPHONE

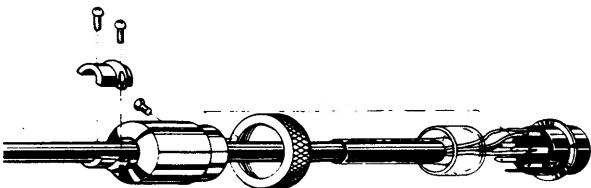
The microphone supplied with the IC-740 is the IC-HM7 which contains a preamplifier. The optional electret condenser type stand microphone IC-SM5 can be used. Their circuit diagrams are shown.

Should you wish to use a different microphone, make certain it has a proper preamplifier.

Schematic diagram of IC-SM5



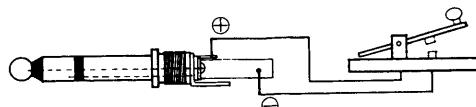
Microphone plug exploded view



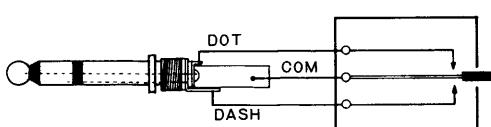
### 3 - 8 CW KEY

When operating CW, connect a key to the Key Jack with a 1/4 inch 3-P plug. The connection of the plug is shown below.

Wiring for a hand key or external electronic keyer.

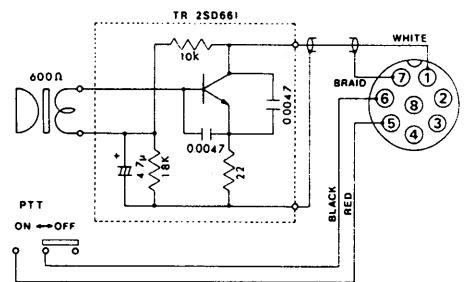


Wiring for an iambic paddle (when optional keyer unit is installed.)



If the terminals have polarity, be sure to make the correct connection. Note that the keyed voltage when switching with semiconductors or relays with resistors in the circuit, should be adjusted to be below 0.4 Volts!

Schematic diagram of IC-HM7



### 3 - 9 EXTERNAL SPEAKER

The IC-740 contains an internal speaker, and is also designed so that it can drive an external speaker from the

external (EXT) speaker jack on the rear panel. Be sure the impedance of the external speaker is 8 ohms, and remember that with the external speaker connected, the internal speaker is disabled.

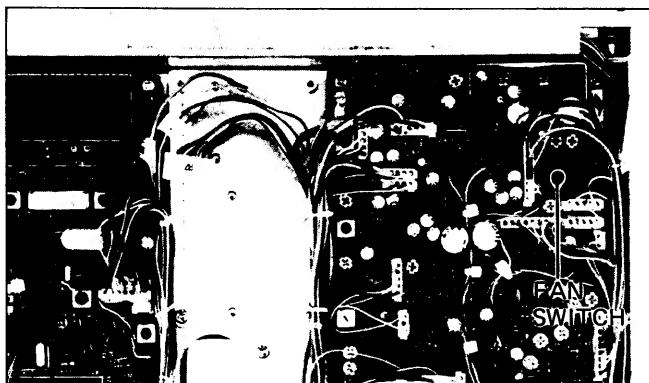
### 3 - 10 HEADPHONES

Any good headphone set, including stereo type, that have 4-16 ohms impedance can be used. With the plug inserted halfway into the PHONES jack, both the headphone and speaker will operate. This is convenient when others wish to listen in on the station, or you wish to record contacts using a tape recorder connected to the headphone jack. With a stereo headphone set inserted this way, however, the headphone will lose the sound on one side. With the plug inserted completely, only the headphone works.

### 3 - 11 COOLING FAN

The rear of the PA unit is designed to provide for adequate cooling, but with 200 Watt input the final stage produces quite a bit of heat, and its temperature may rise during prolonged transmissions. The fan is connected to a temperature monitoring circuit which monitors the temperature of the final stage. The fan operates as follows:

1. The fan does not operate in the receive mode.
2. When you slide the FAN switch located on the MAIN unit under the top cover (Refer to the picture shown below.) toward the front panel side, the cooling fan will operate during both transmit and receive modes to provide more efficient cooling.



3. When the temperature rises to a point ( $75^{\circ}\text{C}$ ) detected by the monitor circuit the fan will operate during both transmit and receive and much more rapidly to provide additional cooling. At this time stop transmitting and investigate the cause of overheating i.e., antenna mismatch, etc. Correct the cause of the overheating before starting to transmit again.

### 3 - 12 POWER SUPPLY

It is recommended that you use the IC-PS15 or the built-in unit IC-PS740 as a power supply for base station operation.

If you wish to use another type of power supply make sure that it meets the voltage, current requirements. Note carefully the overvoltage protection, for a runaway regulator can destroy the IC-740, be especially careful that a voltage of more than 16 Volts cannot be supplied to the transceiver. Do not connect the power supply, antenna, accessory plug, or microphone with the Power Switch in the ON position. Be especially careful not to transmit without an antenna or dummy load hooked up. If the fuse blows replace it with a 20 Amp fuse, only after fixing the cause. Do not turn the Power Switch ON and OFF repeatedly for this may cause the readout to mis-display. Should this occur, turn the set OFF and wait for approximately 30 seconds before turning it back ON.

### 3 - 13 CAUTIONS

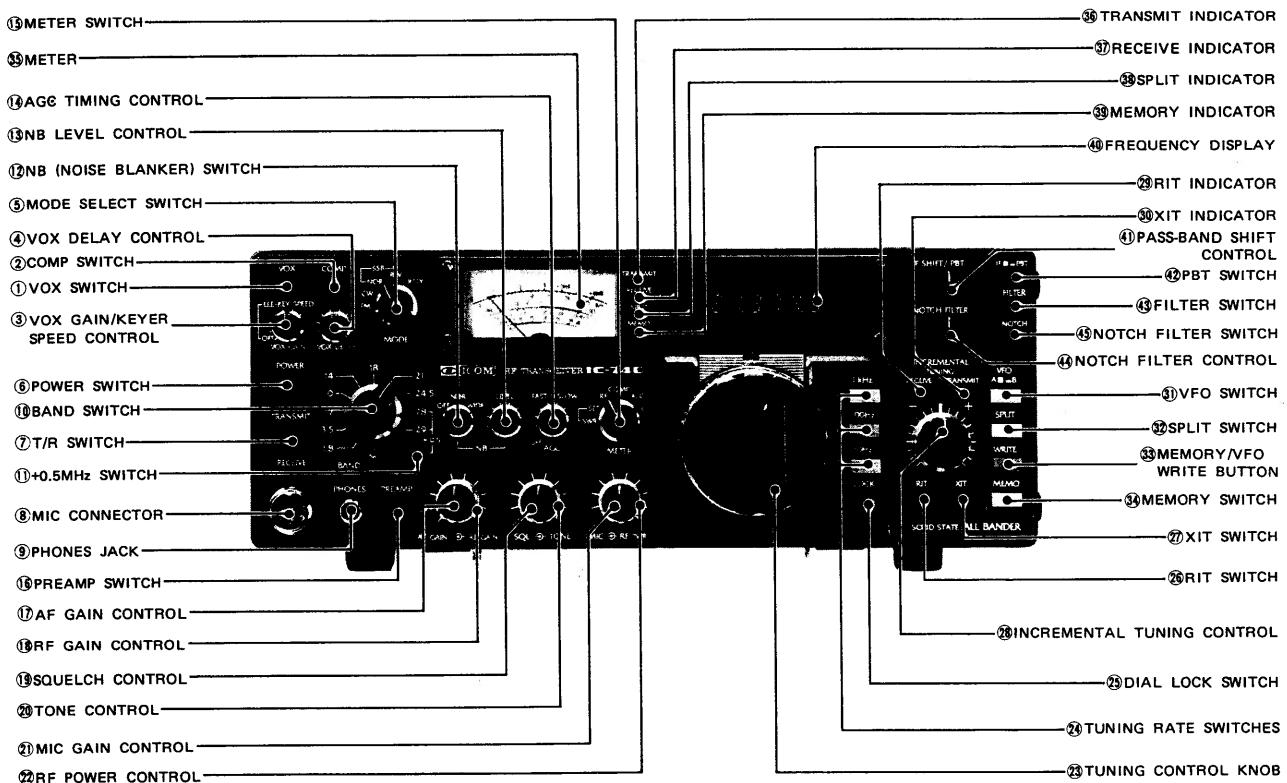
As the unit has already been closely adjusted with highly sophisticated measuring instruments, never tamper with the turnable resistors, coils, trimmers, etc.

C-MOS is used in the Logic unit as well as the PLL. C-MOS ICs are very susceptible to excessive static charges and over current and care must be used when handling them. Therefore, avoid touching the Logic unit and the nearby circuitry unless absolutely necessary. When it is necessary to check the circuitry, observe the following points.

Ground all measuring instruments, the soldering iron, and other tools. Do not connect or disconnect the C-MOS IC from its socket, or solder it when the power is on. Do not apply voltage of less than  $-0.5$  or more than  $+5$  Volts to the input terminals of the IC. DO NOT MEASURE WITH AN OHMMETER.

## SECTION 4 OPERATING CONTROLS

### 4 - 1 FRONT PANEL



#### 1. VOX SWITCH

This switches the VOX circuit ON and OFF. When it is in the ON (in) position, in SSB or FM, T/R switching is accomplished by means of a voice signal. In CW operation, semi-break-in switching by means of keying is possible.

#### 2. COMP (SPEECH PROCESSOR) SWITCH

Switches the speech processor circuit ON and OFF. This circuit enables greater talk power and better results in DX operation.

#### 3. VOX GAIN/KEYER SPEED CONTROL

This control adjusts input signal level via the microphone to the VOX circuit. For VOX operation in SSB and FM, adjust the control so that the VOX circuit will operate with normal speech.

When the optional electronic keyer unit is installed and the set is in CW mode, this control adjusts keying speed of the keyer.

#### 4. VOX DELAY (VOX time constant) CONTROL

This controls the transmit to receive switching time. Adjust it so transmit to receive switching will not occur during short pauses in normal speech.

#### 5. MODE SELECT SWITCH

Selects any one of four operating modes (FM is option). There are two modes in SSB mode as follows:

SSB-NOR: For normal SSB operation, upper sideband (USB) for 10MHz band and above, and lower sideband (LSB) for 7MHz band and below.

SSB-REV: For reverse SSB operation, lower sideband (LSB) for 10MHz band and above, and upper sideband (USB) for 7MHz band and below.

#### 6. POWER SWITCH

The POWER SWITCH is a push-lock type switch which controls the input DC power to the IC-740. When the external AC power supply (IC-PS15) or optional built-in

AC power supply (IC-PS740) is used, the switch also acts as the AC power supply switch. When the switch is pushed in and locked, power is supplied to the set. When the switch is pushed again and released, power is cut to all circuits except the PA unit. When the BC-10A is used, power will also be supplied to the CPU. (Refer to page 3.)

#### 7. T/R (TRANSMIT/RECEIVE) SWITCH

This switch is for manually switching from transmit to receive and vice versa. Set the switch to RECEIVE (down) and the IC-740 is in the receive mode. Set the switch to TRANSMIT (up) and it switches to transmit. When switching with the PTT switch on the microphone or with the VOX switch set to ON, the T/R switch must be in the RECEIVE position.

#### 8. MIC CONNECTOR

Connect the supplied microphone or optional microphone, IC-SM5 or scanning microphone IC-HM10 to this jack. If you wish to use a different microphone, refer to the drawing on page 4.

#### 9. PHONES JACK

Accepts a standard 1/4 inch headphone plug for headphones of 4 ~ 16 ohms. Stereo phones can be used without modification.

#### 10. BAND SWITCH

The BAND SWITCH is a 10 position rotary switch used for selecting one of the 500KHz segments. The selectable bands are 1.8MHz, 3.5MHz, 7MHz, 10MHz, 14MHz, 18MHz, 21MHz, 24MHz and 28MHz. (28MHz band is separated to four 500KHz segments, and use ⑪ + 0.5MHz switch for upper 500KHz segments on 28MHz and 29MHz.)

#### 11. +0.5MHz SWITCH

This switch is for selecting upper 500KHz segment on 28MHz or 29MHz band. This switch is negated when the other band is selected.

#### 12. NB (NOISE BLANKER) SWITCH

When pulse type noise such as automobile ignition noise is present, set this switch to the NOR or WIDE position. The noise will be reduced to provide comfortable reception.

The blanking time can be selected NORMAL and WIDE by this switch. It will be effective against any type noises.

#### 13. NB LEVEL CONTROL

Controls the threshold level of the noise blinder. Adjust the control so that incoming noises will be disappeared.

#### 14. AGC TIMING CONTROL

For changing the time-constant of the AGC (Automatic Gain Control) circuit. By turning the control clockwise, the AGC voltage is released more slowly. Adjust the control to provide comfortable reception.

When the control is in the OFF position, the AGC function is turned OFF and the S-meter does not swing even if a

signal has being received. (The AGC does not actuate on the FM mode.)

#### 15. METER SWITCH

In the transmit mode, the meter has five functions.

1. Ic Indicates the collector current of the final transistors.
2. ALC Indicates the ALC level. The meter begins to function when the RF output power reaches a certain level.
3. COMP Indicates the compression level when the speech processor is in use.
4. RF Indicates an approximate RF output power.
5. SET/SWR SWR can be measured by setting this switch to the SET position and calibrating the meter needle to the "SET" position with the RF POWER control, then setting this switch to the SWR position.

#### 16. PREAMP SWITCH

Switches the preamplifier for the receiver.

#### 17. AF GAIN CONTROL

Controls the audio output level in the receive mode. Clockwise rotation increases the level.

#### 18. RF GAIN CONTROL

Controls the gain of the RF section in the receive mode. Clockwise rotation gives the maximum gain. As the control is rotated counterclockwise, the needle of the METER rises, and only signals stronger than the level indicated by the needle will be heard.

#### 19. SQUELCH CONTROL

Sets the squelch threshold level. To turn OFF the squelch function, rotate this control completely counterclockwise. To set the threshold level higher, rotate the control clockwise.

#### 20. TONE CONTROL

Controls the receiver audio tone. Ajust the control to provide comfortable reception.

#### 21. MIC GAIN CONTROL

Adjusts the level of modulation according to the input of the microphone. Clockwise rotation increases the microphones gain. As the input will vary with different microphones and different voices, the knob should be turned until the Meter needle, in the ALC mode, begins to move slightly within the ALC zone. In the SSB mode when the speech processor is in use, the MIC GAIN CONTROL sets a clipping limit, while the RF POWER CONTROL sets the RF drive level to the maximum power level, where ALC starts at the saturation point of the amplifiers.

#### 22. RF POWER CONTROL

Controls the RF output power 10 Watts to maximum (SSB: 100 Watts PEP, CW, RTTY: 100 Watts). Clockwise rotation increases the output power.

### **23. TUNING CONTROL KNOB**

Rotating the TUNING CONTROL KNOB clockwise increases the frequency, while rotating it counterclockwise decreases the frequency. The frequency is changed in 10Hz, 100Hz or 1KHz steps which is according to the TUNING RATE switches. One complete rotation of the tuning knob results in a 1KHz frequency increase or decrease in 10Hz steps, 10KHz in 100Hz steps and 100KHz in 1KHz steps.

When the 10Hz steps tuning rate is selected, by turning the tuning control knob faster, the 100Hz steps tuning rate is automatically selected. This makes it very convenient to make a QSY over a wide frequency range.

### **24. TUNING RATE SWITCHES**

The small vernier marks on the tuning knob are changed to correspond to 10Hz, 100Hz or 1KHz steps which is selected by pushing the switch either 10Hz, 100Hz or 1KHz.

### **25. DIAL LOCK SWITCH**

After the IC-740 is set to a certain frequency for rag chewing, mobile operation, etc., by pushing the DIAL LOCK switch, the VFO is electronically locked at the displayed frequency, thus inactivating the operation of the tuning knob. To change frequency, the dial lock must first be disengaged by pushing and releasing the DIAL LOCK switch again.

### **26. RIT SWITCH**

Switches the RIT (Receiver Incremental Tuning) circuit ON and OFF.

### **27. XIT SWITCH**

Switches the XIT (Transmitter Incremental Tuning) circuit ON and OFF.

### **28. INCREMENTAL TUNING CONTROL**

Shifts the receive frequency  $\pm 1.5\text{KHz}$  to either side of the transmit frequency when the RIT is ON, and shifts the transmit frequency to either side of the receive frequency when the XIT is ON. Rotating the control to the (+) side raises the receive or transmit frequency, and rotating to the (-) side lowers the receive or transmit frequency. The frequency shift by turning the control is not indicated on the frequency display.

When both the RIT and XIT switches are ON, the receive and transmit frequencies are the same, and this frequency can be shifted either side from the displayed frequency by the control.

### **29. RIT INDICATOR**

Illuminates when RIT is turned ON.

### **30. XIT INDICATOR**

Illuminates when XIT is turned ON.

### **31. VFO SWITCH**

You can select either of the two built in VFO's with this

switch. It also selects the relationship of the two VFO's with the SPLIT switch. The switch performs the following operations according to its position.

A. (NORMAL) Selects the "A" VFO for both transmit and receive.

A. (SPLIT) Selects "A" VFO for receive and "B" VFO for transmit.

B. (NORMAL) Selects the "B" VFO in both transmit and receive.

B. (SPLIT) Selects "B" VFO for receive and "A" VFO for transmit.

### **32. SPLIT (TRANSCEIVE/SPLIT) SWITCH**

Selects the relationship of the two VFO's. In the NORMAL (out) position, one VFO is for both transmit and receive. In the SPLIT (in) position, one VFO is for transmit and the other is for receive.

### **33. MEMORY/VFO WRITE BUTTON**

By pushing this button, A VFO's frequency is written into Memory, or one VFO's frequency is transferred to the other VFO.

### **34. MEMORY SWITCH**

Push this switch when you wish to write a frequency into memory, or to call a memorized frequency.

### **35. METER**

When in the receive mode the meter acts as an S meter regardless of the position of the meter select switch. Signal strength is indicated on a scale of S1-S9, and S9 to S9+60dB.

In the transmit mode the meter has five functions which are selected by the Meter Switch (15).

### **36. TRANSMIT INDICATOR**

Illuminates when the transceiver is in the transmit mode.

### **37. RECEIVE INDICATOR**

Illuminates when the squelch is opened in the receive mode.

### **38. SPLIT INDICATOR**

Illuminates when the transceiver is in the split frequency operation.

### **39. MEMORY INDICATOR**

Illuminates when the memory switch is pushed ON.

### **40. FREQUENCY DISPLAY**

The frequency of the IC-740 is displayed on a luminescent display tube. Since the 1MHz and 1KHz decimal points are displayed, the frequency can easily be read. The frequencies indicated are the carrier frequencies of each mode in, USB, LSB and CW, and the mark frequency in RTTY.

Remember, if you turn the RIT or XIT SWITCH ON to change the frequency and rotate the INCREMENTAL

TUNING CONTROL knob, the frequency displayed will not change.

#### 41. PASS-BAND SHIFT (TUNING) CONTROL

Allows continuous shifting of the pass-band from upper or lower side in SSB, CW and RTTY. This will reduce interference by a nearby signal. When the PBT switch is pushed ON, this control allows continuous tuning of the pass-band selectivity by moving the filter up to 800Hz from the upper or lower side in SSB, CW and RTTY. This not only improves selectivity, but also can improve the audio tone. Normal position is in the center position and is 2.4KHz wide in SSB.

#### 42. PBT SWITCH

Switches the IF SHIFT function and PASS-BAND TUNING function.

#### 43. FILTER SWITCH

Selects the combination of the second IF (9MHz) filter and the third IF (455KHz) filter to improve the selectivity.

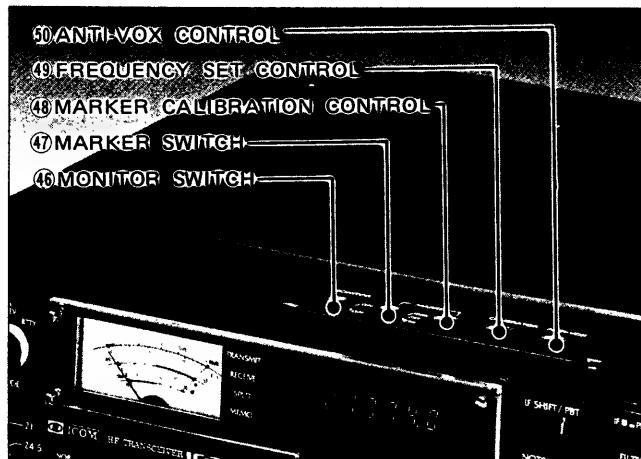
#### 44. NOTCH FILTER CONTROL

Shifts the notch filter frequency. Adjust the control so that the interference is reduced.

#### 45. NOTCH FILTER SWITCH

Switches the notch filter function ON and OFF.

### 4 - 2 TOP COVER



#### 46. MONITOR SWITCH

In the SSB transmit mode, the transmitting IF signals can be monitored by turning this switch ON. At this time, use headphones or reduce receiver audio volume to prevent howling.

#### 47. MARKER SWITCH

When an optional marker oscillator unit is installed, this switch turns the marker oscillator ON or OFF.

The marker frequency is available on every 25KHz or 100KHz step.

#### 48. MARKER CALIBRATION CONTROL

Calibrates the marker frequency with a standard frequency such as WWV.

#### 49. FREQUENCY SET CONTROL

This control is for fine adjustment of the reference frequency of the PLL unit, which is local oscillator frequency. Do not turn it unless you want to change the frequency.

#### 50. ANTI-VOX CONTROL

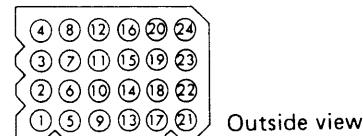
In VOX (SSB) operation, the VOX circuit may be operated by sound from the speaker causing a switch to transmit. This trouble can be prevented by adjusting the input level of the ANTI-VOX circuit with this control along with the VOX gain control so that the VOX circuit only operates by the operator's voice, not by sound from the speaker.

### 4 - 3 REAR PANEL CONNECTIONS

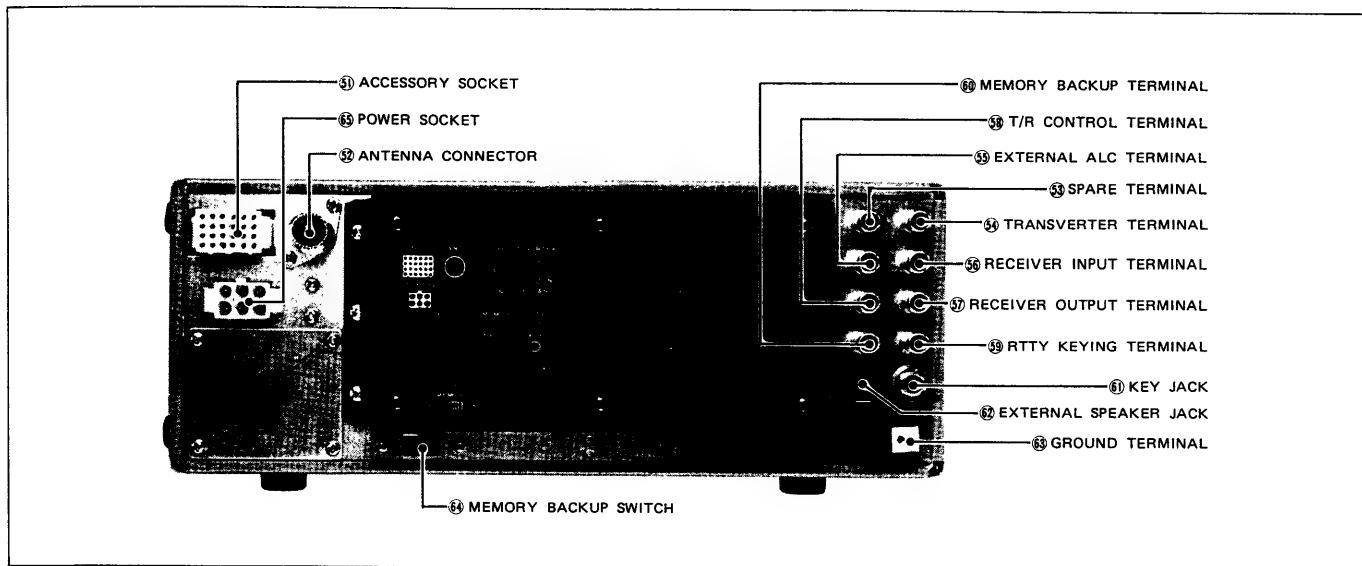
#### 51. ACCESSORY (ACC) SOCKET

Various functions are available through the accessory socket such as modulation output, receiver output, T/R change-over, and so forth. The table below shows those terminals.

#### ACC SOCKET CONNECTIONS



PIN No.	FUNCTION
1.	Output from the discriminator circuit (When optional FM unit is installed).
2.	13.8 Volts DC in conjunction with the power switch operation.
3.	Connected to Push-to-talk, T/R change-over switch. When grounded, the set operates in the transmit mode.
4.	Output from the receive detector stage. Fixed output regardless of AF output or AF gain.
5.	Output from Transmitter MIC amplifier stage. (Input for MIC gain control stage.)
6.	8 Volts DC available when transmitting. (relay can not be directly actuated. Max. 5mA).
7.	Input for external ALC voltage.
8.	Ground
9.	NC (no connection)
10.	8 Volts DC available when the 28MHz band is selected.
11.	Input for TRANSVERTER control. When 8 Volts DC is applied, the set can operate with a transverter.
12.	Output reference voltage for band switching.
13.	Output for external band switching.
14.~24.	NC



## 52. ANTENNA (ANT) CONNECTOR

This is used to connect an antenna to the set. Its impedance is 50 ohms and connect with a PL-259 connector.

## 53. SPARE TERMINAL

This terminal is available for your personal use, such as for adding accessory circuit, etc., if desired.

## 54. TRANSVERTER TERMINAL

VHF and UHF operation using a suitable transverter with the IC-740 is possible. This terminal is for Transverter connection. The output is a few milliwatts.

## 55. EXTERNAL ALC TERMINAL

This terminal can be used for input terminal of external ALC signal from a linear amplifier or transverter.

The ALC voltage should be in 0V ~ -4V.

## 56. RECEIVER INPUT TERMINAL

This is an input terminal which is connected directly to the receiver.

## 57. RECEIVER ANTENNA OUTPUT TERMINAL

This is a terminal to which received signals from the antenna connector are conducted after the signal passes through the transmit/receive antenna switching circuit. Usually the receiver IN and OUT terminals are jumpered. The receiver antenna output terminal is usually used when another receiver is used or a preamplifier is connected to the IC-740A.

## 58. T/R CONTROL TERMINAL

Controls Transmit/Receive for an external linear amplifier or transverter. This terminal can be used to switch 24V 1A DC. Don't exceed this limit.

## 59. RTTY KEYING TERMINAL

This terminal is for RTTY keying (Frequency Shift Keying). The keying signals should be H-level (+5V) for the MARK and L-level (0V) for the SPACE.

## 60. MEMORY BACKUP TERMINAL

For connection of a 9 ~ 12V DC power supply. For mobile installation the current drain is low, so connection to the vehicle's battery can be made. For fixed installation use of the IC-BC10A is recommended.

## 61. KEY JACK

For CW operation, connect a key here using a standard 1/4 inch 3-P plug. For electronic keying the terminal voltage must be less than 0.4V DC.

When an optional electronic keyer unit is installed, an iambic keyer paddle can be used with a 1/4 inch 3-P plug.

## 62. EXTERNAL SPEAKER JACK

When an external speaker is used, connect it to this jack. Use a speaker with an impedance of 8 ohms. When the external speaker is connected, the built-in speaker does not function.

## 63. GROUND TERMINAL

To prevent electrical shock, TVI, BCI and other problems, be sure to ground the equipment through the GROUND TERMINAL. For best results use as heavy a gauge wire or strap as possible and make the connection as short as possible, even in mobile installations.

## 64. MEMORY BACKUP SWITCH

When this switch is in the ON position, the power to the CPU of the set is supplied continuously, if you use the optional built-in power supply or memory backup power source, even when the POWER switch on the front panel is turned OFF. At this time, the programmed frequencies in the memory channels, the operating frequencies of the two VFO's are also retained.

When this switch is set at the OFF position, all the power, including that to the CPU, is turned OFF by turning the POWER switch OFF, so that all frequencies are erased.

## 65. POWER SOCKET

This is for connection of the IC-PS15's DC power cord, or other suitable power supply.

## SECTION 5 OPERATING INSTRUCTIONS

### 5 - 1 HOW TO TUNE

The following instructions are for tuning in any mode. Please read carefully and understand fully before turning ON your unit. Proper tuning is necessary for optimum operation.

#### 5 - 1 - 1 FREQUENCY DISPLAY ON EACH MODE

When the set is first turned ON, the following readouts will appear on the FREQUENCY DISPLAY.

Band	Displayed Frequency (MHz)		
	CW-RTTY-FM	LSB	USB
1.8MHz	1.600.0	1.601.5	1.598.5
3.5 "	3.600.0	3.601.5	3.598.5
7 "	7.100.0	7.101.5	7.098.5
10 "	10.100.0	10.101.5	10.098.5
14 "	14.100.0	14.101.5	14.098.5
18 "	18.100.0	18.101.5	18.098.5
21 "	21.100.0	21.101.5	21.098.5
24.5 "	24.600.0	24.601.5	24.598.5
28 "	28.100.0	28.101.5	28.098.5
28.5 "	28.600.0	28.601.5	28.598.5
29 "	29.100.0	29.101.5	29.098.5
29.5 "	29.600.0	29.601.5	29.598.5

#### EXAMPLE:

When the 7MHz band and LSB are selected, the display will be as follow:

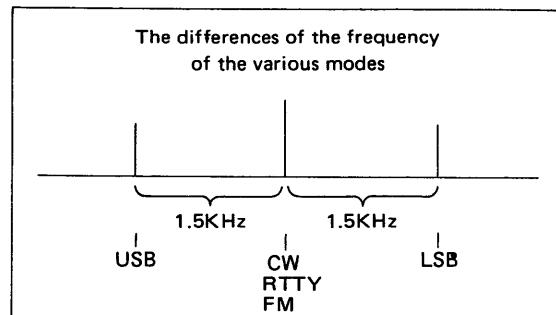
7 10 15

When changing to other modes, the display will be as follows:

USB:	7 09 8 5
CW:	7 10 0 0
RTTY:	7 10 0 0
FM:	7 10 0 0

The displayed frequency shows the carrier frequency. To avoid the trouble of recalibrating the dial when you change the operating mode, the displayed frequency is set to shift to the carrier frequency of each mode automatically. For the differences of frequency shifts of the various modes, refer to the following figure.

When changing to other bands, 100KHz and lower digits of the frequency display will remain as it had in the previous display.



#### EXAMPLE:

When the frequency display shows 14.255.5MHz, and if you switch to the 21MHz band, and the frequency display will show 21.255.5MHz. (When you switch to the 3.5MHz band, it will show 3.755.5MHz.)

#### 5 - 1 - 2 TUNING CONTROL KNOB

The transmit or receive frequency is displayed on a 7 segment Electroluminescent display down to 100Hz digits. Rotating the tuning knob clockwise increases the frequency, while turning counterclockwise decreases the frequency in which steps are selected by the TUNING RATE switches, i.e., 10Hz, 100Hz or 1KHz steps.

When the 10Hz steps tuning rate is selected, by turning the tuning control knob faster, the 100Hz steps tuning rate is automatically selected.

One complete rotation of the tuning knob results in 1KHz with 10Hz steps, 10KHz with 100Hz steps, or 100KHz with 1KHz steps with a frequency increase or decrease.

Exact calibration is not necessary as the displayed frequency will always be correct but you may calibrate the scale on the tuning knob for use as an analog type frequency display.

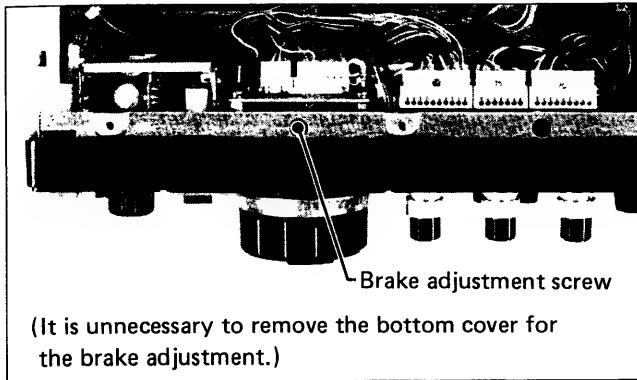
If you want to calibrate the scale during operation, set the frequency readout to 0.0KHz, push the dial lock switch, then set the large increment on the tuning scale to line up with the indicator arrow and then push the dial lock switch again.

The tuning knob scale may require recalibration if you:

1. Turn the knob while the frequency is locked by use of the Dial Lock switch.
2. Turn the knob beyond the band edge.

#### Brake Adjustment

If the knob is too loose or too stiff for comfortable use, you can adjust the torque by tightening or loosening the brake adjustment screw accessible from underneath the set.



The following instructions should be used to adjust the tension of the Tuning Knob.

1. The Tuning knob tension will become tighter by turning the brake adjustment screw clockwise, and will become looser by turning the screw counterclockwise.
2. While performing this adjustment, the Tuning knob must be turned continuously as the screw is adjusted in order to set the tension for a comfortable touch.

The displayed frequency will not go beyond the highest band edge even by turning the tuning knob clockwise, or beyond the lowest band edge by turning the knob counterclockwise.

The frequency range of each band is shown in the following chart.

Band	Frequency Range (MHz)
1.8	1.400.0 ~ 2.099.9*
3.5	3.400.0 ~ 4.099.9
7.0	6.900.0 ~ 7.599.9
10.0	9.900.0 ~ 10.599.9
14.0	13.900.0 ~ 14.599.9
18.0	17.900.0 ~ 18.599.9
21.0	20.900.0 ~ 21.599.9
24.0	24.400.0 ~ 25.099.9
28.0	27.900.0 ~ 28.599.9
28.5	28.400.0 ~ 29.099.9
29.0	28.900.0 ~ 29.599.9
29.5	29.400.0 ~ 29.999.9

\*NOTE: In the range of 2.000.0 ~ 2.099.9, the frequency display will show as 1.000.0 ~ 1.099.9.

### 5 - 1 - 3 TUNING RATE SWITCHES

Pushing one of the Tuning Rate switches will change the basic tuning rate of the set.

When the 10Hz switch is pushed, the tuning rate becomes 10Hz. The 10Hz may be read from the increments on the tuning knob.

When the 100Hz switch is pushed, the tuning rate becomes 100Hz.

When the 1KHz switch is pushed, the tuning rate is changed to correspond to 1KHz steps. The last significant-digit on the display will remain as the previous one. This position will allow you to quickly QSY over a great frequency range.

### 5 - 1 - 4 DIAL LOCK SWITCH

After the IC-740 is set at a certain frequency for rag chewing, mobile operation, etc., by pushing the Dial Lock switch the VFO is locked at the displayed frequency, thus inactivating the operation of the tuning knob. To change the frequency, the Dial Lock must first be disengaged by pushing and releasing the Dial Lock switch again.

### 5 - 1 - 5 VFO SWITCH

The CPU in the IC-740 contains two "VFO's" for both receiving and transmitting. The VFO's are labeled "A" VFO and "B" VFO and are selectable with the VFO Switch. This dual VFO system gives the IC-740 many very convenient features. Please read this section very carefully and perform the operation several times until you are comfortable with the system.

1. "A" VFO is for both transmitting and receiving and is selected by placing the VFO switch in the "A" position. The transmit and receive frequency will be controlled by "A" VFO, displayed on the frequency readout, and stored in "A" memory.
2. "B" VFO is for both transmitting and receiving and is selected by placing the VFO switch in the "B" position. The transmit and receive frequency will be controlled by "B" VFO, displayed on the frequency readout, and stored in "B" memory.

#### EXAMPLE:

When the set is turned ON (7MHz and LSB are selected), 7.101.5 will be displayed on the readout.

This will occur whether the VFO switch is in either the "A" or "B". Rotating the tuning knob clockwise will increase the frequency in 100Hz (10Hz or 1KHz) steps. Rotating the tuning knob counterclockwise will decrease the frequency in 100Hz (10Hz or 1KHz) steps.

- Switching from one VFO to the other VFO does not clear the first VFO. The frequency is retained in VFO's memory.

#### EXAMPLE:

If 14.125.0MHz is set with "A" VFO, and the VFO switch is set to "B" VFO, the frequency readout will show "B" VFO's frequency, but 14.125.0MHz is still stored in "A" VFO's memory. Returning the VFO switch to "A" VFO position, and 14.125.0 will be displayed on the readout. Accordingly, if the switch is placed in the "B" VFO position, the frequency that was set with the "B" VFO will

appear. This allows you to set a certain frequency with one VFO, work up and down the band with the other VFO, and periodically check the set frequency simply by switching between "A" and "B" VFO. It also allows you to search for a clear frequency with one VFO, while keeping your operating frequency on the other VFO. When you have found a clear frequency, switch back to your operating frequency, inform the station you are in contact with of the new frequency, and switch back. It's that simple!

#### 5 - 1 - 6 SPLIT SWITCH

Pushing the SPLIT switch will change the relationship of the two VFO's. In the NORMAL (out) position, one VFO is for both transmit and receive. In the SPLIT (in) position, one VFO is for transmit and the other is for receive, so that this will allow you to operate split transmit/receive frequencies on the same band.

##### EXAMPLE:

Set "A" VFO to 7.085.0MHz and "B" VFO to 7.255.0 MHz.

Return the VFO Switch to "A" VFO then set the SPLIT Switch to the SPLIT position. 7.085.0MHz will be shown on the readout during receive ("A" VFO) and 7.255.0MHz during transmit ("B" VFO). You are now receiving on 7.085.0MHz and transmitting on 7.255.0MHz. Setting the VFO switch to "B" VFO to reverse the above.

#### 5 - 1 - 7 RIT (RECEIVE INCREMENTAL TUNING)

By using the RIT circuit, you can shift the receive frequency  $\pm 1.5\text{KHz}$  either side of the transmit frequency without moving the transmit frequency itself. Therefore, when you get a call slightly off frequency, or when the other station's frequency has shifted, you can tune in the frequency without disturbing the transmitting frequency. By pushing the RIT switch the RIT circuit is turned ON and the RIT Indicator is lit.

The receive frequency can be shifted with the INCREMENTAL TUNING Control knob.

When the Control knob is in the "0" position, the transmitting and receiving frequencies are the same.

Rotating the control to the (+) side raises the receiving frequency, and rotating to the (-) side lowers the frequency. To turn OFF the RIT function, again push and release the RIT switch and the RIT Indicator will go OFF. When the RIT circuit is OFF, the transmit and receive frequencies are the same regardless of the setting of the control knob.

**NOTE:** The RIT circuit is operational when the frequency is locked with the dial lock switch. The frequency shifted by turning the INCREMENTAL TUNING control is not indicated on the frequency display. When the transmitting and receiving frequencies differ by more than 1.5KHz, use "A" and "B" VFOs.

#### 5 - 1 - 8 XIT (XMITTER INCREMENTAL TUNING)

You can shift the transmit frequency  $\pm 1.5\text{KHz}$  on either side of the receive frequency without moving the receive frequency the same function as the RIT by using the XIT circuit.

By pushing the XIT switch, the XIT circuit is turned ON and the XIT Indicator is lit.

The transmit frequency can be shifted with the INCREMENTAL TUNING Control.

**NOTE:** When both the RIT and XIT switches are pushed, the receive frequency and transmit frequency become the same frequency, and it can be shifted to either side from the displayed frequency by the INCREMENTAL TUNING control.

#### 5 - 1 - 9 MEMORY/VFO WRITE BUTTON

This button allows desired frequencies to be written into the memories for each band, and allows either VFO's to be brought to the exact frequency of the other VFO without turning the tuning knob. Therefore, it is very easy to make a few KHz split transmit/receive frequencies.

##### EXAMPLE:

When "A" VFO is 14.255.5MHz and "B" VFO is 14.355.0 MHz, pushing the VFO switch to select "B" VFO, then the MEMORY/VFO WRITE button, "B" VFO's frequency becomes the same as "A" VFO's (14.255.5MHz). Now the "A" VFO's frequency is memorized in the "B" VFO, and you can operate anywhere with "A" VFO or "B" VFO. When you want to return to the previous frequency (14.255.5MHz), switch back to the other VFO. It's very easy. Also, you can make several KHz split frequency operations with "A" VFO and "B" VFO, within a few moments. To reverse this (A the same as B), select "A" VFO first, then push the MEMORY/VFO WRITE button.

#### 5 - 1 - 10 MEMORY OPERATION

##### MEMORY-WRITING

Only "A" VFO can be used for memory-writing.

1. Set the TUNING CONTROL knob to the desired frequency, using "A" VFO. For example, set it for 14.255.5MHz on the display (when 14MHz and USB are selected).
2. Push the MEMORY Switch. If no frequency has been programmed since turning the power of the unit ON, 14.098.5 (14MHz, USB) will be shown on the display and the unit will receive on this frequency.
3. One push of the MEMORY/VFO WRITE Button erases the previous programmed frequency (14.098.5) and programs the new frequency (14.255.5) into memory.
4. Program any desired frequency into memory for each band in the same manner.
5. There is a memory for each band. The 28MHz band consists of four segments, and there is a memory for each one. However, the memory can be used for all segments. For example when 28.055.0 is written in the memory, it can be used for 28.555.0, 29.055.0 and 29.555.0MHz also.

Also, there is only one memory for 1.8MHz and 3.5MHz bands. However the memory can be used for the both bands. For example, when 1.805.5 is written in the memory, it can be used for 3.805.5 as well.

#### **MEMORY-READING**

Just push the MEMORY Switch. At whichever frequency the "A" or "B" VFO has been set, that previously programmed frequency is recalled. When the MEMORY Switch is pushed again and released, the previous operating frequency of that VFO will again be shown on the display.

The programmed frequencies in the memories are maintained as long as the power, including MEMORY BACKUP power, of the set is not turned OFF, or new frequency reprogrammed. When a MEMORY BACKUP power source is connected, all programmed frequencies in the memories and the operating frequencies of both "A" and "B" VFO's are retained even when the POWER Switch is turned OFF.

## **5 - 2 SSB OPERATION**

#### **5 - 2 - 1 RECEIVING**

After connecting an antenna, microphone, etc., set knobs and switches as follows.

POWER SWITCH	OFF (OUT)
T/R SWITCH	RECEIVE (DOWN)
VOX SWITCH	OFF (OUT)
NOISE BLANKER (NB)	
SWITCH	OFF
NB LEVEL CONTROL	Completely Counterclockwise
AGC CONTROL	Center (12 o'clock)
PREAMP SWITCH	OFF (OUT)
VFO SWITCH	A (OUT)
TUNING RATE	
SWITCHES	Desired Rate
MODE SWITCH	SSB-NOR
AF GAIN CONTROL	Completely Counterclockwise
RF GAIN CONTROL	Completely Clockwise
SQUELCH CONTROL	Completely Counterclockwise
TONE CONTROL	Center (12 o'clock)
P.B. SHIFT CONTROL	Center position
BAND SWITCH	Desired Band
RIT SWITCH	OFF
XIT SWITCH	OFF
SPLIT SWITCH	OFF (OUT)
DIAL LOCK SWITCH	OFF (OUT)
MEMORY SWITCH	OFF (OUT)
PBT SWITCH	IF SHIFT (OUT)
FILTER SWITCH	OFF (OUT)
NOTCH FILTER SWITCH	OFF (OUT)

Now turn ON the power switch. The meter lamp will be illuminated and 71015 will be shown on the FREQUENCY display (when 7MHz and LSB are selected).

In SSB operation there is both a USB (upper side band)

and an LSB (lower side band). LSB is usually used on the 3.5 and 7MHz bands, while USB is usually used on the 10MHz band and above.

Slowly turn the AF GAIN control clockwise to a comfortable level. Rotate the tuning knob until a signal is received. The meter needle will move according to the signal strength, so tune for the highest possible meter reading and the clearest audio. If you cannot get a clear signal, you may be receiving in the opposite sideband. If so, change the mode to the proper sideband.

#### **5 - 2 - 2 NB (NOISE BLANKER)**

Set the NB (noise blanker) switch in the NOR position when there is pulse type noise, such as ignition noise from automobile motors, and turn the NB LEVEL control clockwise so that noise will be suppressed and even weak signals will be received comfortably.

When the NB switch is set in the WIDE position, the noise blanker will effectively work for "woodpecker's noise", however, if the receiving signal is too strong, the noise blanker may work with the receiving signal itself, and some distortion may cause in the receiving audio or keying form. At this time, set the N.B. Switch in the NOR position, or turn the NB switch OFF.

#### **5 - 2 - 3 AGC (AUTOMATIC GAIN CONTROL)**

The IC-740 has a fast attack/slow release AGC system which holds the peak voltage of rectified IF signals from the IF amp circuit for a certain period. Therefore, during the pauses in normal speech of the received signal, uncomfortable noise will not be heard. The meter indicates the peak value for a certain period, facilitating reading of the meter "S" function.

For normal SSB reception, turn the AGC control clockwise to the SLOW position. Turn the AGC control counterclockwise to the FAST position, when tuning or receiving signals with short interval fading. When in the FAST position, the time constant is shortened.

When this control is set at the OFF position, the AGC circuit is turned OFF, and the S-meter does not work even if a signal is received. However the RF GAIN control is still active and the needle of the meter moves depending on the control position.

#### **5 - 2 - 4 PREAMP SWITCH**

Turn the PREAMP Switch ON (in) when receiving weak signals. In the ON position, an RF preamplifier is inserted into the receiving antenna circuit, increasing sensitivity and giving easy reception.

#### **5 - 2 - 5 PASS-BAND SHIFT CONTROL**

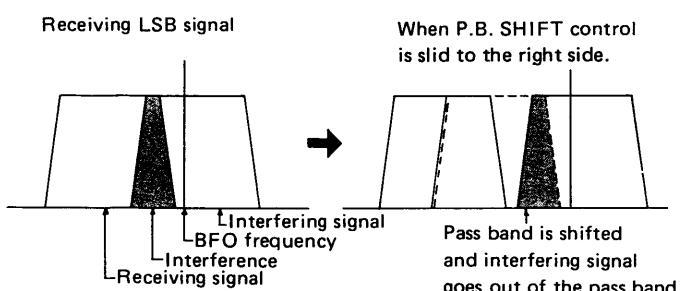
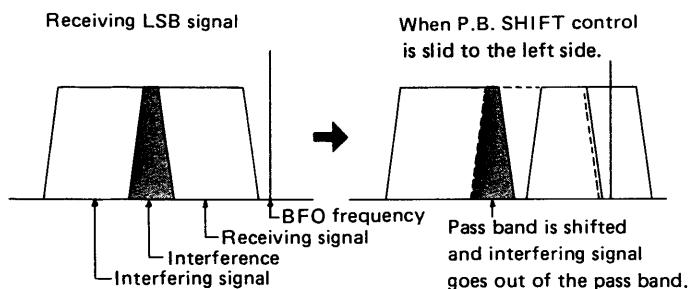
Pass-Band Shift Control is a system in the receive mode to shift the pass-band of the IF upper or lower side continuously. This is very effective in reducing interference from nearby signals.

To use the Pass-Band (IF) Shift system, set the PBT switch in the IF (out) position and slide the control toward right or left side. The center position is the normal pass-band condition.

For example, while receiving in the LSB mode, if you get interference from a lower frequency (interfering signals are high pitched tones), shift the pass-band by sliding the P.B. SHIFT control to the left side. When the interfering signals are low-pitched tones, they are from a higher frequency, and you should shift the pass-band by sliding the P.B. SHIFT control to the right side.

When receiving in the USB mode, the pass-band is shifted in the opposite manner. Interference from a higher frequency will be high-pitched tones, and the P.B. SHIFT control should be slid to the right side. Interference from a lower frequency will be low-pitched tones and the P.B. SHIFT control is slid to the left side.

This control can also be used for audio tone adjustment, so it may be set for the most comfortable reception.

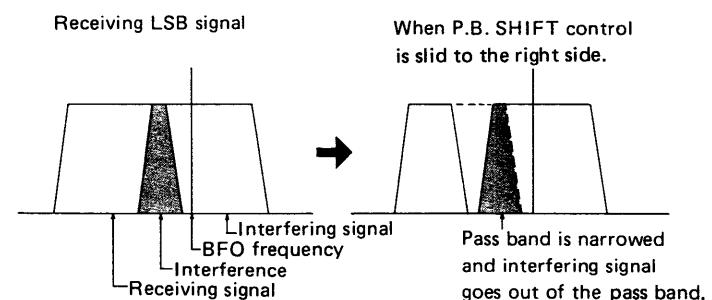
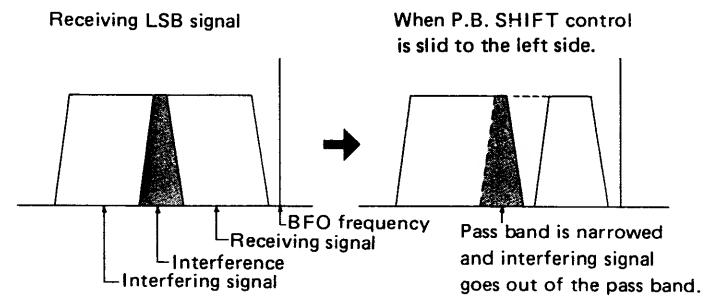


When the PBT switch is set in the PBT (in) position, the Pass-Band Shift system will be changed to the Pass-Band Tuning system.

The Pass-Band Tuning (PBT) is a system in the receive mode to narrow the band width (selectivity) of the frequencies that will pass through the crystal filter electronically from either the upper or lower side continuously by up to 800Hz. This is very effective in reducing interference from nearby signals.

To use the PBT system, slide the control the same as the Pass-Band Shift system.

The center position is the widest position and is equivalent to the normal SSB band width.



#### 5 - 2 - 6 FILTER SWITCH

This switch selects the combination of the internal filters. When an optional filter is installed, this function will be more effective. Select and install the optional filter(s) to suit your favorite mode(s).

#### 5 - 2 - 7 NOTCH FILTER

This circuit notches a frequency in the IF pass-band, so this is effective to reduce interference such as a beat-tone signal.

To use this function, push the NOTCH FILTER switch ON and slide the NOTCH FILTER control so that the interference is reduced.

#### 5 - 2 - 8 TRANSMITTING

Before transmitting, listen in the receive mode to make sure your transmission will not interfere with other communications. If possible, use a dummy load for adjustment instead of an antenna. Set knobs and switches as follows.

MIC GAIN	CENTER (12 o'clock) position
RF POWER CONTROL	FULLY COUNTERCLOCKWISE
METER SWITCH	ALC

Other knobs and switches are left in the same positions as for receiving. When the T/R switch is moved to transmit, or when the PTT (push to talk) switch on the microphone is depressed, the TRANSMIT Indicator is illuminated. By speaking into the microphone, the meter needle will move according to the strength of your voice and SSB signals will be transmitted. Set the MIC GAIN control so that the meter needle stays well within the ALC zone at voice peaks. If you wish to increase the output power, turn the RF POWER Control clockwise and adjust to obtain the desired RF output power of between 10 watts and 100 watts (approximately).

Change to the receive mode by moving the T/R switch to receive, or release the microphone PTT switch.

#### 5 - 2 - 7 HOW TO USE THE SPEECH PROCESSOR

The IC-740 has a low distortion AF speech processor which enables greater talk power and better results in DX operation. Follow the steps below for use of the Speech Processor:

MIC GAIN CONTROL CENTER (12 o'clock)

RF POWER CONTROL Fully Counterclockwise

COMP SWITCH ON

METER SWITCH COMP

Switch to transmit and turn the RF POWER CONTROL clockwise while speaking into the microphone until you obtain the desired RF "PEAK" output power of between 10 watts and 100 watts (approximately).

Adjust the MIC GAIN CONTROL to a point where the meter needle just begins to move.

The Speech Processor should be turned OFF or MIC GAIN CONTROL carefully set for minimum compression for all communication other than DX operation for a very natural voice quality.

#### 5 - 2 - 10 HOW TO USE THE VOX CIRCUIT

The IC-740 has a built-in VOX (voice operated relay) which allows automatic T/R switching by voice signals into the microphone. For VOX use, set the knobs and switch as follows:

VOX GAIN CONTROL  
    FULLY COUNTERCLOCKWISE  
VOX DELAY CONTROL  
    FULLY CLOCKWISE  
ANTI VOX CONTROL (on the top)  
    FULLY COUNTERCLOCKWISE

Push the VOX switch on the front panel to the ON (in) position. Leaving the T/R switch in the RECEIVE position and without pushing the PTT switch, turn the VOX GAIN control clockwise while speaking into the microphone. At a certain point, the T/R switching circuit will be activated by your voice. This is the proper position for the VOX GAIN control. Set the VOX GAIN control at a level which provides for T/R switching at your normal voice level. Transmit-release time (the time delay before the set automatically returns to receive when you stop talking) is controlled by the VOX DELAY control. Turning the control counterclockwise makes the time shorter. Set it at a position which is comfortable and which allows for short pauses in normal speech.

Adjust the ANTI VOX control so that the VOX circuit is not activated by sounds from the speaker by turning the control clockwise while receiving a signal.

#### 5 - 2 - 12 MONITOR

The transmitting IF signals can be monitored in the SSB mode. So you can check the quality of the transmitting signals and conditions of the speech processor and so on.

To use this function, turn the MONITOR switch on the top cover ON and adjust the AF GAIN control to a comfortable audio level. At this time, use headphones to prevent howling which will be caused by picking up sounds from the speaker.

### 5 - 3 CW OPERATION

#### 5 - 3 - 1 RECEIVING

For CW reception, set the MODE Switch for CW mode.

Other switches and knobs are set the same as for SSB reception.

In addition to the crystal band-pass filter, Narrow filters are optional for this unit. When the FILTER Switch is set at the ON (in) position, this filter is activated and the total selectivity of CW reception is improved. With these filters, internal noise is reduced for comfortable CW reception and an improved signal to noise ratio (S/N).

Also, use the Noise Blanker, AGC switch and/or PREAMP Switch depending on the receiving conditions, the same as SSB reception.

#### 5 - 3 - 2 TRANSMITTING

Insert the keyer plug into the KEY Jack on the rear panel of the unit, and set knobs and switches as follows:

RF POWER CONTROL     Fully counterclockwise  
METER SWITCH           RF  
VOX GAIN/KEYER SPEED  
CONTROL               OFF

Other knobs and switches are set the same as for CW reception.

By setting the T/R switch to TRANSMIT, the TRANSMIT indicator is lit and shows that you are ready for CW transmission. When you key the keyer, the meter needle moves and your CW signal is transmitted. To increase the transmitting power, turn the RF POWER Control clockwise to adjust while watching the meter needle on the Po scale for the desired output power.

When the optional keyer unit is installed, connect an iambic paddle with the supplied 3-P key plug to the KEY jack on the rear panel.

Then adjust keying speed by turning the VOX GAIN/KEYER SPEED CONTROL clockwise for your favorite keying speed.

The other procedures are the same when using a hand keyer or an external electronic keyer.

### 5 - 3 - 3 CW SIDE-TONE (MONITOR)

When keying the side-tone oscillator is activated and an 800Hz tone will be heard. The loudness of the tone is controlled by the CW MONI Control located under the top cover. Rotating the control clockwise will increase the loudness. This tone is also audible in the receive mode and can be used for code practice, adjustment of the keyer, etc.

### 5 - 3 - 4 SEMI BREAK-IN OPERATION

The IC-740 has Semi Break-In CW capability when using the VOX function. When keying, the unit is automatically set in the transmit mode. After keying, it is returned to the receive mode, also automatically, after a given transmit-release delay time constant. Leave the T/R switch in the RECEIVE position, and set the VOX switch in the ON (IN) position.

The transmit release delay time constant is set by adjusting the VOX DELAY Control. Turning the VOX DELAY Control clockwise will make the transmit release time longer. Set it for your own keying speed.

## 5 - 4 RTTY OPERATION

For RTTY operation, a teletypewriter and a demodulator (terminal unit) which is operational with audio input are required. Any demodulator with 2125/2295Hz filters (narrow, 170Hz shift) can be used with the IC-740.

### 5 - 4 - 1 RECEIVING

Audio signals for the demodulator can be supplied from Pin

4 of the ACC socket on the rear panel, or from the PHONES jack on the front panel. The level of the audio signals from Pin 4 of the ACC socket does not vary by turning the AF GAIN Control, and the level is about 300mV P-P maximum.

Set the operating mode for RTTY, by setting the MODE SELECT switch to "RTTY". The other controls are the same as those for SSB reception. When tuning a RTTY signal, set the TUNING RATE SELECT switch in the 10Hz position, and tune to get audio signals of 2125Hz for MARK and 2295Hz for SPACE. (Use the tuning indicator of the terminal unit for easy tuning.) Also slide the P.B. Tune control for clear reception.

### 5 - 4 - 2 TRANSMITTING

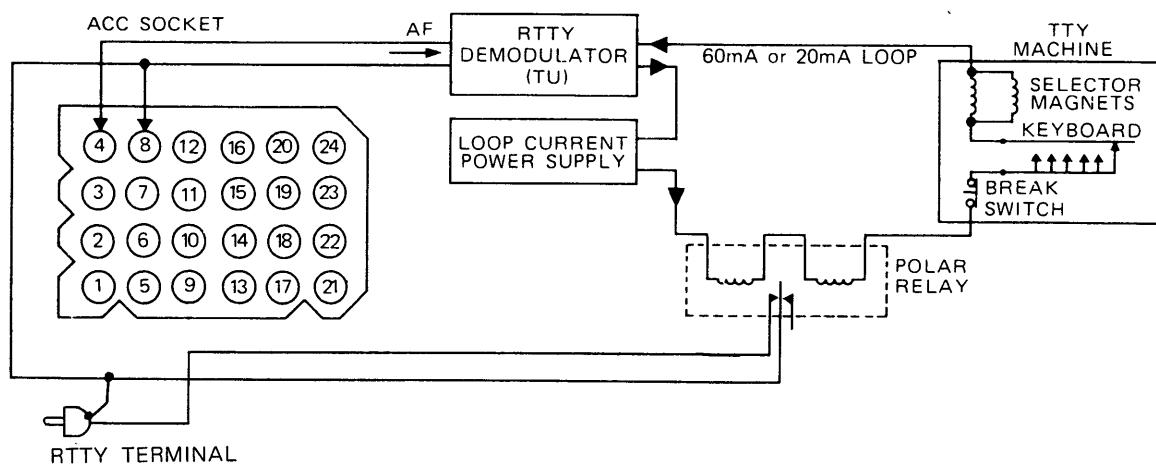
For keying of the Frequency Shift Keying (FSK) circuit insert a high speed relay's coil into the loop current circuit of the teletypewriter, and connect the relay contacts to the RTTY keying terminal on the rear panel. The relay contacts make during the Space and break during the Mark, as shown in the drawing. Fine adjustment of the MARK and SPACE frequencies can be done by adjusting the coil cores in the MAIN unit.

When a level converter for TTL level signals is used, connect the output of the converter to the RTTY keying terminal apply High level (5V) signals for the Mark, and Low (0V) for the Space.

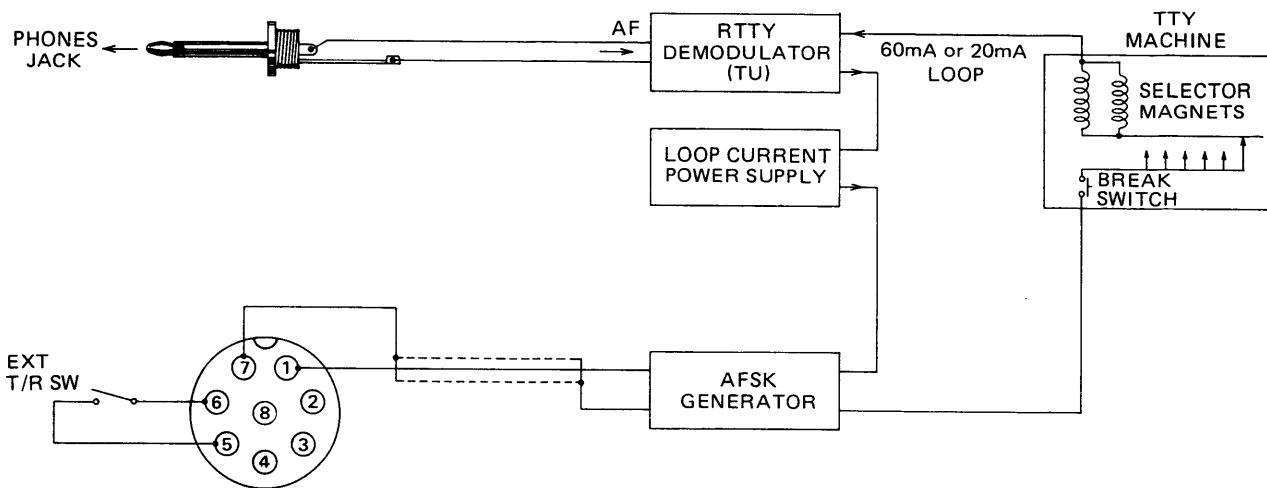
When using an AFSK generator that has 2125Hz for Mark and 2295Hz for Space, connect the output signals for the AFSK to the Mic connector on the front panel and set the Mode to LSB. (See Other Operations chapter.) Doing this, you can use the VOX operation available in this mode, and receive/transmit changeover is very easy.

If you wish to transmit continuously 10 minutes or more, reduce the output power to less than 70% of the full power, by rotating the RF POWER control on the front panel.

#### When a high speed relay is used



### When a AFSK generator is used



## 5 - 5 FM OPERATION (OPTION)

### 5 - 5 - 1 RECEIVING

Set the operating mode for FM, by setting the MODE SELECT switch to "FM". The other controls are the same as those for SSB reception, however, the Pass Band Shift (Tune) control, Notch Filter, Noise Blanker and AGC circuits do not work in this mode.

When tuning an FM signal, tune for maximum signal strength as indicated on the meter and the clearest audio.

### 5 - 5 - 2 TRANSMITTING

Transmitting FM signals is essentially the same as SSB transmission.

Set knobs and switches the same as for SSB operation. However the speech processor can not be used on this mode.

When transmitting the FM signals, the meter (in RF position) will indicate the carrier power, but the meter needle does not move according to your voice such as SSB transmitting.

Adjust the RF POWER control so that the meter needle points to "SET" on the meter scale. Set the METER SELECT switch to the SWR position. With the switch in the SWR position, SWR reading can be seen on the meter. Although this unit is built to handle VSWR of up to 2:1, it is recommended that the antenna(s) be adjusted for the lowest possible VSWR. After taking the reading, return the switch to the other position. ALSO BE SURE THAT THE ANTENNA IMPEDANCE IS 50 OHMS OR THERE MAY NOT BE ANY OUTPUT. OTHERWISE THERE WILL BE DAMAGE TO THE TRANSCEIVER.

The final transistors used in the IC-740 are of good design and are protected to a reasonable extent by circuits incorporated in the set. These devices can be expected to have an indefinite lifetime since there are no cathodes to burn out. Under some conditions, however, they can be abused beyond tolerance and may have to be replaced.

When in doubt about antenna systems, use the lowest power setting possible to achieve meaningful readings. Use a good tuner or transmatch when necessary. Always use caution and exercise judgement when testing RF power generators.

### 5 - 6 - 2 WWV RECEPTION

To receive WWV (or other standard frequency station), set the operating band to 10MHz in the HAM band, and the MODE to any mode. Tune to 10.000.0MHz on the frequency display.

The WWV signal can be used for alignment of a frequency counter, marker oscillator, or the frequency display.

## 5 - 6 OTHER OPERATIONS

### 5 - 6 - 1 VSWR READING

The IC-740 has a built-in VSWR meter for checking antenna matching in order to avoid problems caused by VSWR. Set the METER SELECT switch to the SET position. Set the operating mode to RTTY, and turn the TRANSMIT/RECEIVE switch to TRANSMIT.

### 5-6-3 SIMPLE FREQUENCY ALIGNMENT

A very accurate frequency counter is necessary to align the frequency of the IC-740. However, the frequency can be aligned simply by receiving the WWV signal.

1. Set the frequency display to 10.000.0MHz and be sure that you are receiving the WWV signal.
2. Set the operating mode to CW. A 800Hz beat can be heard.
3. Short the KEY Jack on the rear panel so that the CW side-tone also becomes audible.
4. Rotate the CALIBRATOR Control, located on the top cover, so that the two tones are of the same pitch (in zero beat). If the tones are difficult to adjust because of a difference in their strengths, adjust the CW side-tone level with the CW MONI control, located on the MAIN unit (under the top cover), until the strengths are the same.

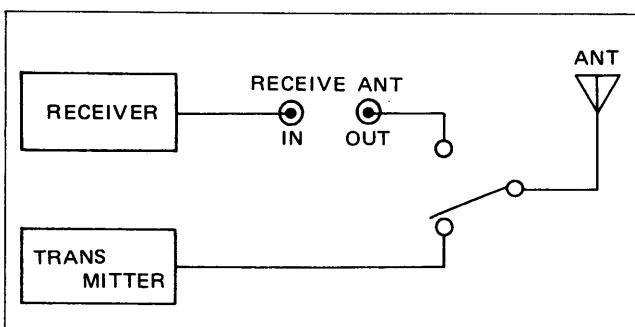
When the optional marker unit, IC-EX241 is installed, operating frequency can be calibrated each 25KHz or 100KHz on the all bands.

#### WHEN ALIGNING THE FREQUENCY, DO NOT PUT THE UNIT IN THE TRANSMIT MODE.

Be sure the T/R switch is in the Receive position, the VOX switch is OFF, and that you do not touch the PTT switch on the microphone.

### 5-6-4 RECEIVE ANTENNA TERMINALS

The RECEIVE ANT IN jack is connected to the input terminal of the receiving section, and the RECEIVE ANT OUT jack is connected to the antenna connector through the internal T/R antenna switching circuit.



These two jacks are normally jumpered with a cable, but can be used for:

1. A receiving preamplifier.
2. A separate receiver.
3. Separate receiver and transmitter antennas.

If you wish to use a receiver preamplifier, connect it between the receiver input and antenna output terminals.

If a separate receiver is used, connect it to the receiver antenna output terminal. For a separate receive antenna connect it to the receiver input terminal.

### 5-6-5 TRANSVERTER CONNECTION

When a transverter control signal (+8V) is applied to Pin 11 of the ACCESSORY socket, the TRANSVERTER terminal can be used for a VHF/UHF transverter INPUT/OUTPUT terminal.

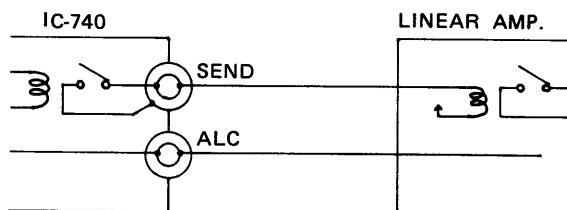
The transverter's input/output frequency and signal level should be as follows:

- Transverter INPUT/OUTPUT Frequency  
28 ~ 30MHz
- Input/Output Level
  - Transmit (Output) : Max. 150mV across a 50 ohm load
  - Receive (Input) : 1μV for S/N 10dB

### 5-6-6 LINEAR AMPLIFIER CONNECTION

The jacks on the rear panel marked "ALC" and "SEND" are a relay built-in for keying a linear amplifier, and the input for ALC from the linear amplifier. For linear amplifier hookup the SEND jack is for an internal relay and the ALC jack is for ALC input.

Internal Connections for Linear Amplifier



The optional linear amplifier IC-2KL and automatic antenna tuner IC-AT100/AT500 can be connected to the IC-740 with their accessory cables as same as other ICOM HF transceivers. Refer to their instruction manuals for detail.

The IC-740 puts out the band control voltage to change operating band automatically for external equipment such as linear amplifier and antenna tuner. The voltage is put out from Pin 13 of the accessory socket. (Refer to page 10.)

Band Control Voltage Chart

BAND (MHz)	Band Control Voltage
1.8	7.0 ~ 8.0V
3.5	6.0 ~ 6.5V
7	5.0 ~ 5.5V
14	4.0 ~ 4.5V
18 - 21	3.0 ~ 3.5V
24 - 28	2.0 ~ 2.5V
10	0 ~ 1.2V

## SECTION 6 CIRCUIT DESCRIPTION

The IC-740 uses a phase-locked-loop (PLL) consisting of two loops for the local oscillator for both transmit and receive. The PLL is controlled by a microcomputer system. The basic circuit uses an up-conversion with a First IF of 39.7315MHz, a Second IF of 9.0115MHz and Third IF of 455KHz. The receiver front end employs the ICOM DFM (Direct Feed Mixer) system, so that incoming signals are directly fed to the mixer, and provides wide dynamic range and high two-signal selectivity.

The circuits are divided into several units. The units are:

### 6 - 1 LOW-PASS FILTER UNIT

The Low-Pass Filter Unit has a low-pass filter for each band and a VSWR detecting circuit.

During receive, the signal from the antenna passes through the Low-Pass Filter Unit which switches to the proper band eliminating the undesired out of band signals and then is fed to the RF Unit.

During transmit, the output signal from the PA Unit is fed to the Low-Pass Filter of the proper band and eliminates all harmonic components, fed to the SWR detecting circuit, and detected for forward power and reflected power, then fed to the antenna terminal.

### 6 - 2 RF UNIT

This unit consists of a receiver preamplifier, band-pass filter for each band, first mixer, 39MHz crystal filter, first IF amplifiers, second mixer, noise blanker circuit and transmitter buffer amplifier.

During receive, the incoming signal passed through the low-pass filter, is fed to a high-pass filter which eliminates strong

BC signals, then to the preamplifier circuit. If the PREAMP switch on the front panel is in ON position, the signal is fed to the preamplifier and amplified about 10dB, then fed to the band-pass filter. The band-pass filter is selected for its respective filter depending on the band selected.

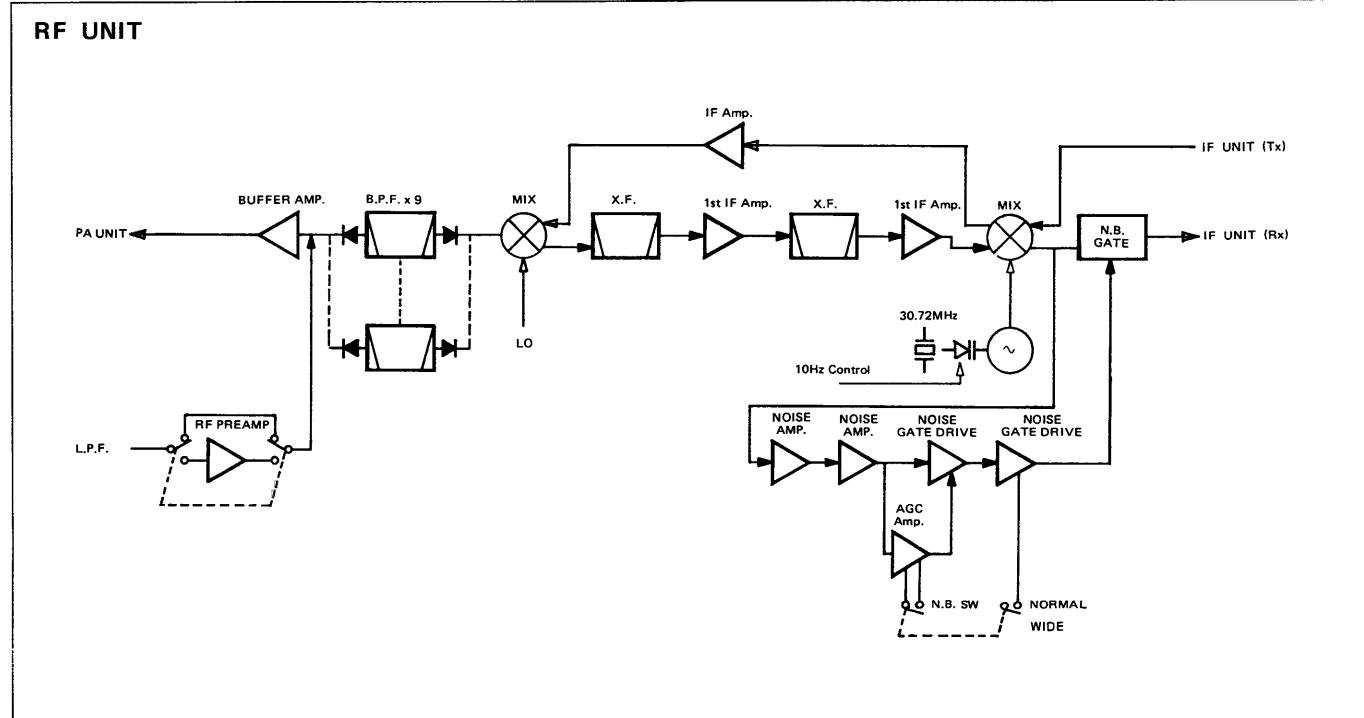
The signal is then passed through a high-level Doubly Balanced Mixer which has an 18dBm intercept point, where it is mixed with the 1st Local Oscillator signal from the VCO unit, becoming a 39MHz signal. It then passes through a third over-tone monolithic filter and is amplified by Q3, 1st IF amplifier, and passes again through a monolithic filter and IF amplifier Q4, and fed to the 2nd mixer.

The 2nd mixer is also a high level DBM, and an amplified 39MHz 1st IF signal is mixed with the 30.72MHz 2nd local oscillator signal to convert it into a 9.0115MHz 2nd IF signal.

The 2nd local oscillator is a VXO (Variable Crystal Oscillator), and its frequency is varied 30.71901MHz - 30.72000 MHz in 10Hz steps, and 30.7191MHz - 30.7200MHz in 100Hz steps by the output signals of the CPU through the D/A converter.

A part of 9MHz 2nd IF signals is fed to the noise blanker circuit. The noise blanker consists of noise amplifiers, a noise detector and noise blanker gate control which blocks the incoming IF signal when noise is present. The AGC time constant of the noise blanker circuit can be changed. It becomes effective for wider noise pulse such as "wood-pecker noise".

During transmit, the 9.0115MHz transmitting signal from the IF unit is fed to the 2nd mixer to convert a 39MHz signal. This output signal is amplified by Q2 and fed to the



1st mixer, the reverse of receive, then to the band-pass filter, and is amplified by Q11 and fed to the PA unit.

### 6 - 3 IF UNIT

This unit is consisting of 9MHz crystal filters for various modes, 2nd IF amplifiers, notch filter, 3rd mixers for receiver and transmitter, 3rd local oscillator (IF shift and Pass Band Tuning control circuit), 455KHz ceramic filter and a speech processor for the transmitter.

During receive, 9MHz IF signals from the RF unit are passed through a crystal filter which is selected by operating mode and/or the filter switch, then amplifiers Q7 and Q8. The notch filter circuit is connected to the drain of Q7, and provides 25dB or more attenuation at its notch point. The notch point can be adjusted  $\pm 1.5\text{KHz}$  by the NOTCH FILTER CONTROL on the front panel.

The amplified IF signals are fed to the 3rd mixer IC2 with 9.4665MHz 3rd local oscillator signals to convert them to 455KHz 3rd IF signals.

455KHz 3rd IF signals are fed to a 455KHz ceramic filter or crystal filter, installed optionally, selected by operating mode and/or the FILTER SWITCH to obtain specified selectivity.

The 3rd local oscillator is a VXO (Variable Crystal Oscillator), and its oscillating frequency is shifted  $\pm 1.5\text{KHz}$  or more by the PASS-BAND SHIFT CONTROL on the front panel. This varies the relationship of the center frequencies of 9MHz and 455KHz filters, and narrows total pass band when the PBT SWITCH on the front panel is turned ON. Then the signals are fed to the MAIN unit through a buffer amplifier Q1.

During transmit, a DSB signal fed from the MAIN unit is fed to the 455KHz ceramic filter (or crystal filter installed optionally) which removes its unwanted sideband to get a

455KHz SSB signal. This SSB signal is fed to the transmit mixer IC1 through the buffer amplifier Q1, COMP switch and RF POWER control.

When the speech processor circuit is turned ON, an SSB signal put out from Q1 is fed to an amplifier Q2, then to the clipper circuit consisting of D1 and D2. The clipped signal is then fed to the transmit mixer through the COMP switch and RF POWER control.

At the transmit mixer, the 455KHz SSB signal is mixed with a 9.4665MHz local oscillator signal which is the same for receive to get a 9MHz SSB signal. The 9MHz SSB signal is fed to the 9MHz crystal filter to remove undesired signals of the out of the pass band, then the filtered signal is fed to the RF unit through an amplifier Q6.

A part of the filtered signal is fed to the receiver IF circuit which is activated when the MONITOR switch on the top is turned ON for monitoring its own transmitting signals.

### 6 - 4 MAIN UNIT

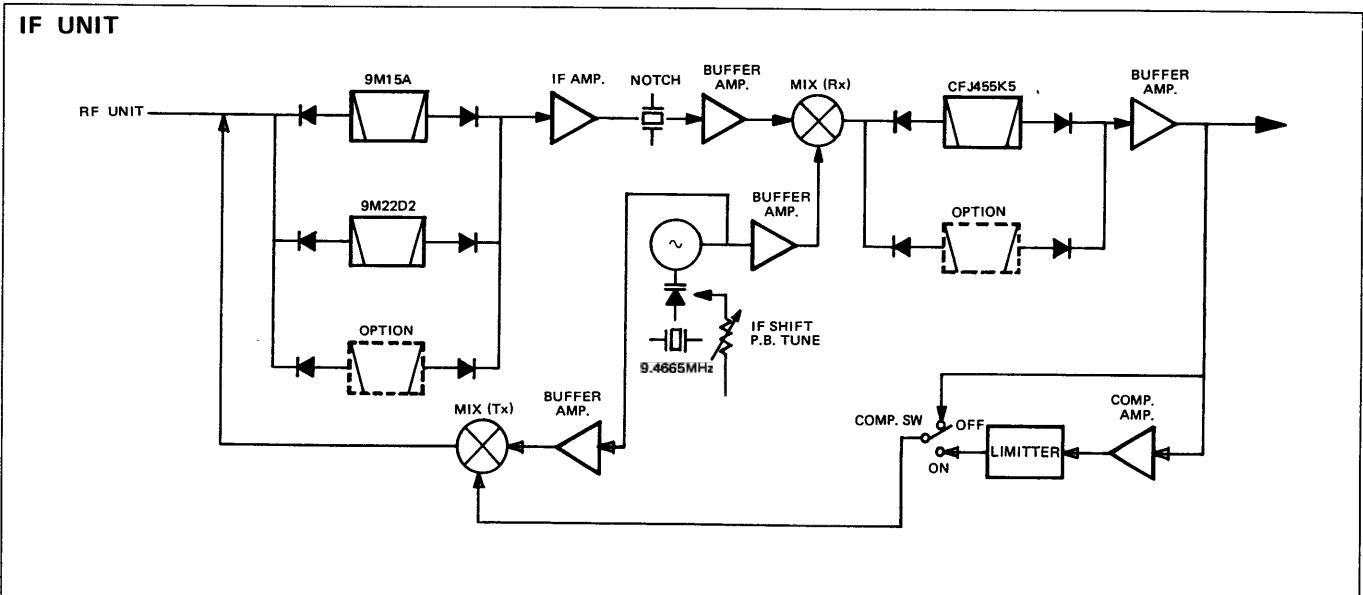
This unit consists of 3rd IF amplifiers, a product detector/balanced modulator, AF amplifiers, squelch control circuit, BFO, MIC amplifiers, CW control circuit, meter amplifiers, etc.

During receive, 455KHz 3rd IF signals from the IF unit are amplified by Q1 and Q2, then fed to the product detector IC1.

The BFO circuit consists of Q13, X1 for CW and RTTY, X2 for LSB and X3 for USB, and oscillates about 9MHz. The BFO signal is fed to a mixer IC2 with the 9.4665MHz 3rd local oscillator signal the same one for receiver and transmitter to get an about 455KHz BFO signal.

The 455KHz BFO signal is fed to the product detector IC1.

The detected AF signal is fed to squelch control Q6, which blocks the AF signal to be fed to the next stage when



squelch is closed. When the squelch is opened, the AF signal is fed to the AF GAIN control then an amplifier Q19 in SSB, RTTY or FM mode, or an AF filter Q18 in CW mode, then the AF power amplifier IC10 to get enough power to drive the speaker.

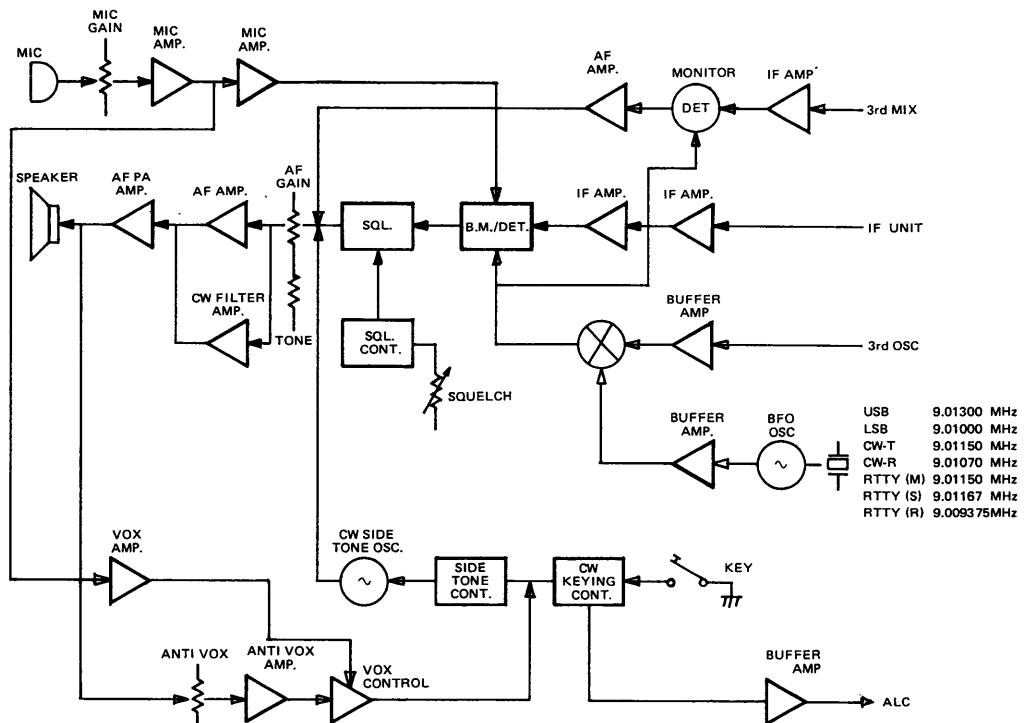
During transmit, an AF signal from the microphone is fed to the AF amplifier IC3, then the balanced modulator; this

being one and the same with the receiver product detector, through the MIC GAIN control.

The balanced modulator modulates the 455KHz BFO signal mentioned above and the AF signal to obtain a 455 KHz carrier suppressed DSB signal.

The DSB signal is then fed to the transmit mixer on the IF unit.

## MAIN UNIT



## 6 - 5 PA UNIT

This unit consists of predriver Q1, driver Q2 and Q3, and power amplifier Q4 and Q5, and they are constructed on the heatsink.

An operating frequency signal from the RF unit is amplified at the predriver Q1 in A class, then the driver Q2 and Q3 push-pull in AB class, and the power amplifier Q4 and Q5 push-pull in AB class to obtain 100 watts output power.

At the driver circuit and power amplifier circuit, negative feedback networks are provided respectively to get the same output power on all bands and to improve IMD characteristic.

The UP/DOWN signal is latched at a half of IC7, and the CLOCK signal is fed to 3-bit counter consisting of IC6 and IC7, then the INTerrupt terminal of the CPU through an inverter. By this signal, the CPU puts out a reset signal to reset the latch buffer and 3-bit counter for the next input.

The other data signals for the band selection, VFO selection, tuning rate selection, etc. are fed to the CPU through the CPU INPUT control circuit.

The CPU reads these data signals, then puts out various control signals to the display circuit and PLL circuit according to the input signals.

## 6 - 6 LOGIC UNIT

This unit consists of a CPU, and UP/DOWN control, CLOCK control and CPU INPUT control circuits, etc.

90 degrees out of phase clock pulses, which are generated by the rotary encoder connected with the tuning control knob directly, are shaped then divided to UP/DOWN signal and CLOCK signal at the UP/DOWN control circuit consisting of IC2, IC3, IC4 and IC5.

## 6 - 7 DISPLAY UNIT

This unit consists of a fluorescent tube for digital display, decoder/driver for the display tube, and DC-DC converter for generating -18V and -5V.

Data signals for display are fed to the decoder/driver IC1 to decode them to seven-segment data and digit data, then to the display tube.

## 6 - 8 PLL UNIT

The PLL of this unit employs mixed-down type and is controlled by data signals put out from the LOGIC unit. The local oscillator Q1 oscillates 13.666MHz with X2. This signal is multiplied 3-times by Q2 and Q3 (totally 9-times) to obtain a 123MHz signal. This frequency can be shifted a few KHz by the INCREMENTAL TUNING CONTROL when the incremental function is turned ON. The VCO Q6 oscillates between 132MHz and 139MHz, and this signal is fed to the mixer Q4 through buffer amplifiers Q7 and Q8 with the 123MHz signal mentioned above. The mixer puts out a mixed down signal of between 9MHz and 16MHz. Then the signal is fed to PLL IC, IC1 through a level converter Q5, compared with 10KHz signal which is divided from 9MHz and locked with it. The VCO output of a 132 - 139MHz signal in 10Khz steps is divided by 10 to produce a 13.2 - 13.9MHz signal in 1Khz steps by high-speed divider IC2. This signal is then fed to the HPL unit through a low-pass filter.

## 6 - 9 HPL UNIT

The 13.2MHz signal from the PLL unit is mixed with a 34.9315MHz signal generated by the local oscillator Q1, to produce a 48.1315 - 48.8315MHz signal.

This 48MHz signal is mixed with a VCO signal from the VCO unit by another mixer IC2 to produce a 1.5 - 21MHz signal.

This signal is fed to a divider IC5 through a low-pass filter, buffer amplifier Q7 and level converter Q6, and divided by 5 to produce a 0.3 - 4.2MHz signal. Then this divided signal is fed to IC4 programmable divider/phase detector, and divided by a number depending on operation band selected and compared with 100Khz signal fed from the PLL unit. The output of the phase detector is fed to the VCO unit through a loop filter consisting of Q3 and Q4.

## 6 - 10 VCO UNIT

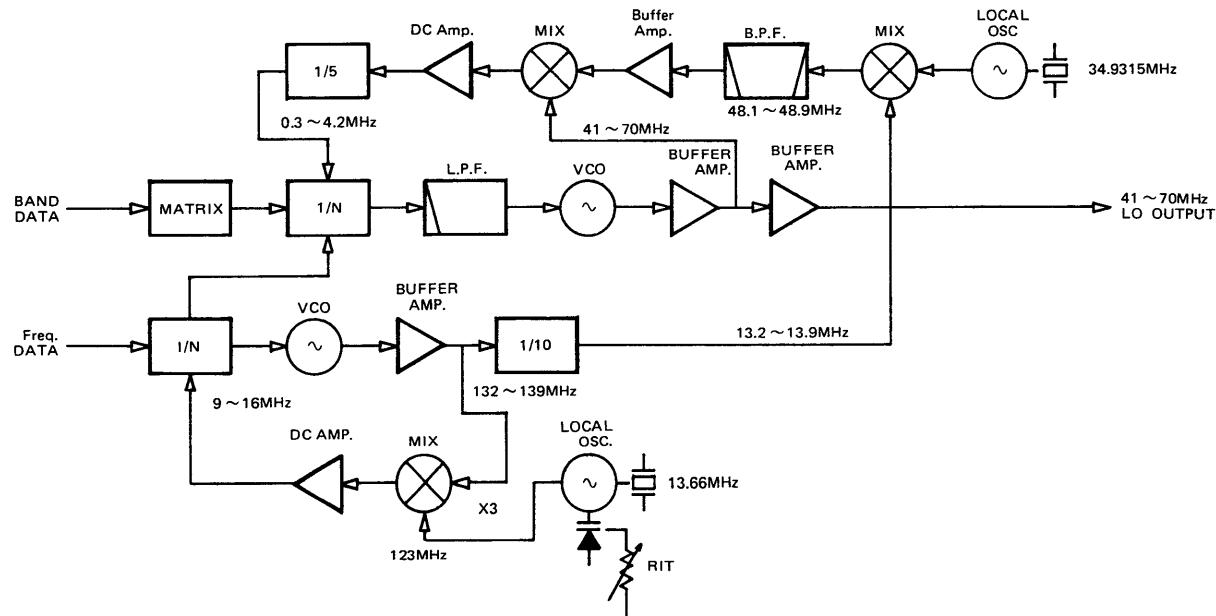
This unit consists of four VCO's and buffer amplifiers.

One of these VCO's is selected by a band signal depending on operating band selected, which are; Q1 is for 1.8, 3.5 and 7MHz, Q2 is 10 and 14MHz, Q3 is 18 and 21MHz, and Q4 is 24 and 28MHz. Each VCO has a varactor diode, and output voltage of the phase detector is applied it to lock the oscillating frequency. The oscillating frequency of the VCO for each band is as follows.

BAND	FREQUENCY RANGE
1.8MHz	41.1315MHz - 41.8315MHz
3.5MHz	43.1315MHz - 43.8315MHz
7 MHz	46.6315MHz - 47.3315MHz
10 MHz	49.6315MHz - 50.3315MHz
14 MHz	53.6315MHz - 54.3315MHz
18 MHz	57.6315MHz - 58.3315MHz
21 MHz	60.6315MHz - 61.3315MHz
24.5MHz	64.1315MHz - 64.8315MHz
28.0MHz	67.6315MHz - 68.3315MHz
28.5MHz	68.1315MHz - 68.8315MHz
29.0MHz	68.6315MHz - 69.3315MHz
29.5MHz	69.1315MHz - 69.8315MHz

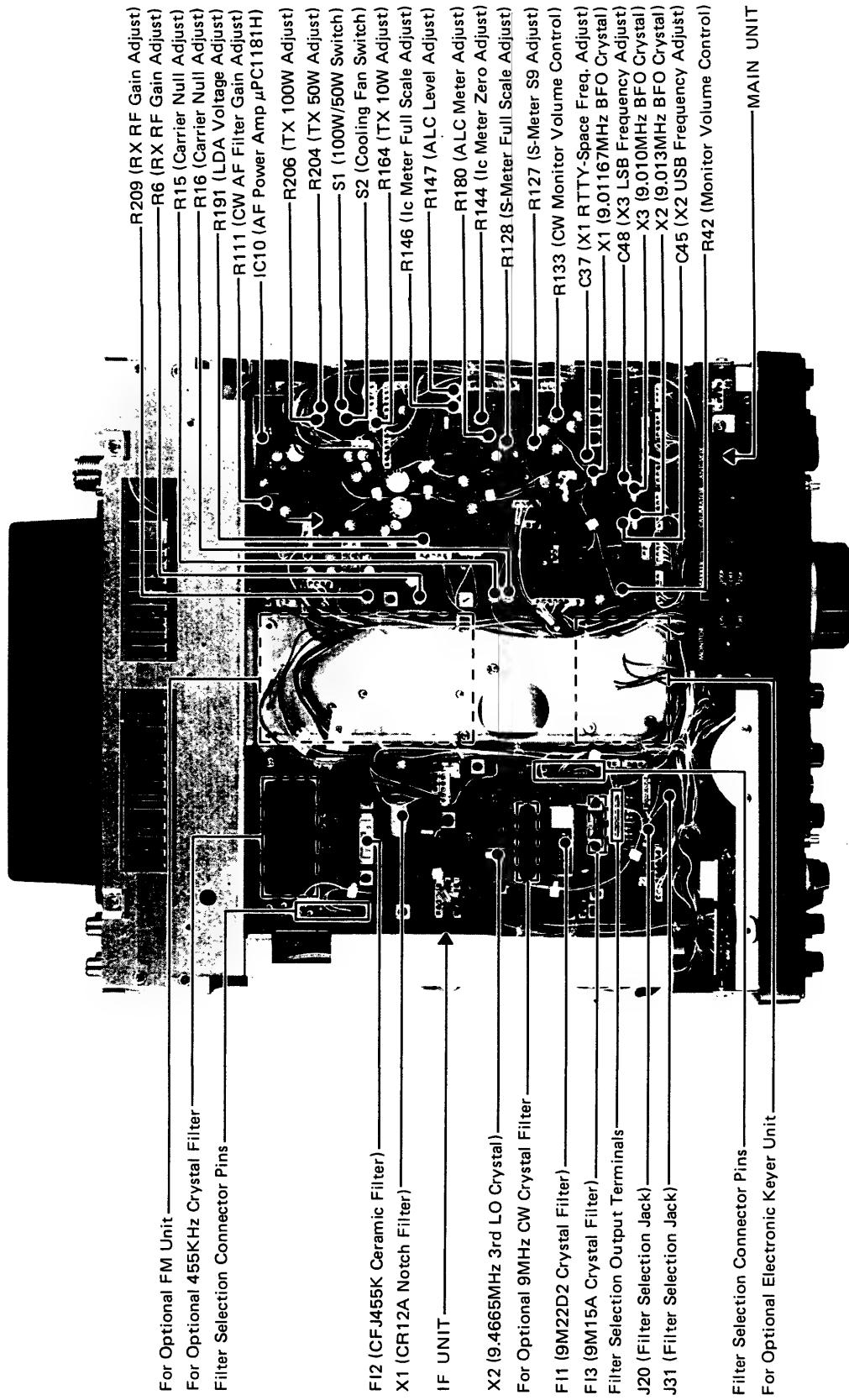
This signal is fed to the 1st mixer of the set as a local oscillator signal through buffer amplifiers Q5 and Q6, and a low-pass filter. A part of the output signal is fed to the HPL unit through a buffer amplifier Q7 to construct a phase-locked loop.

## HPL · VCO · PLL UNIT

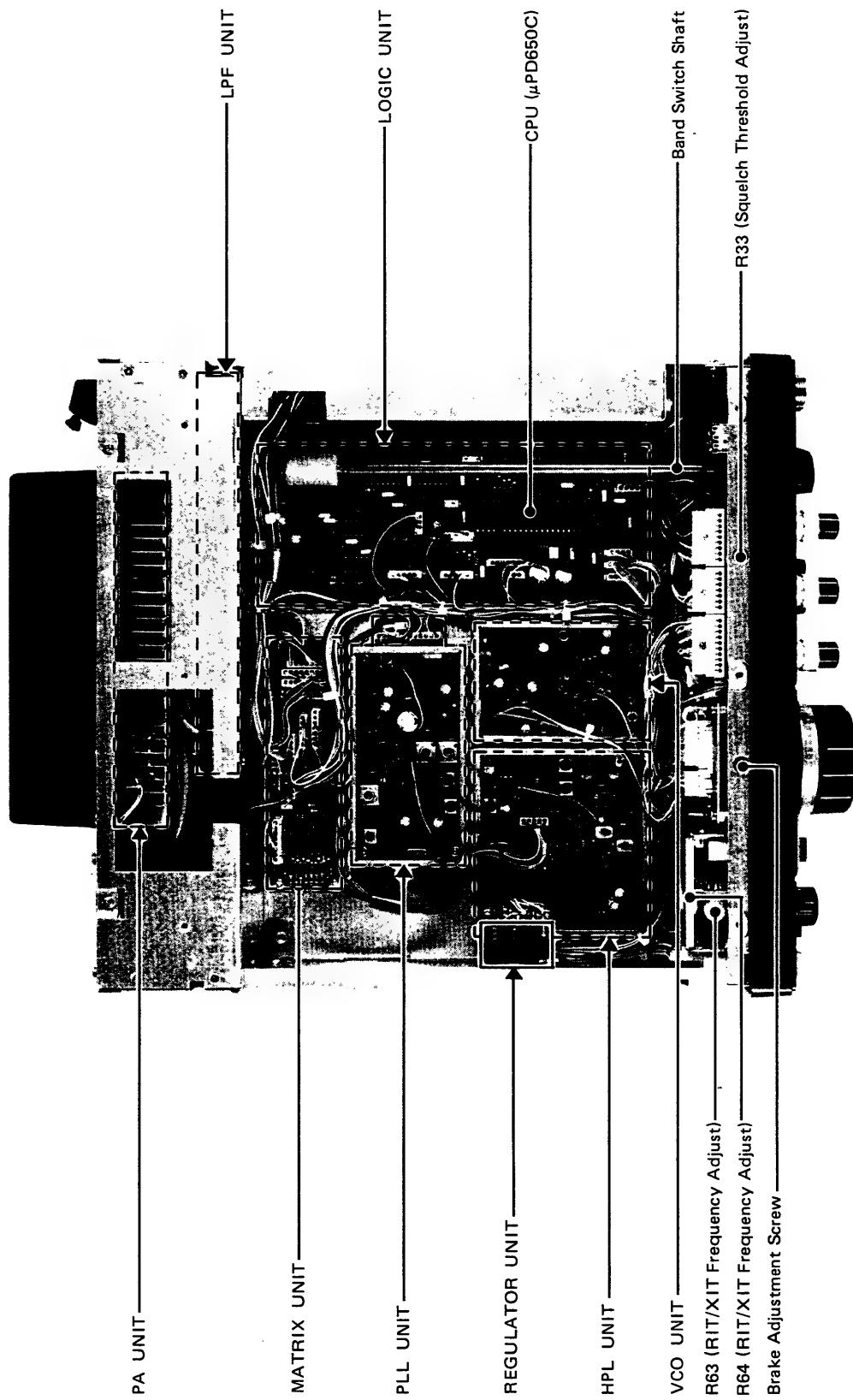


## SECTION 7 INSIDE VIEWS

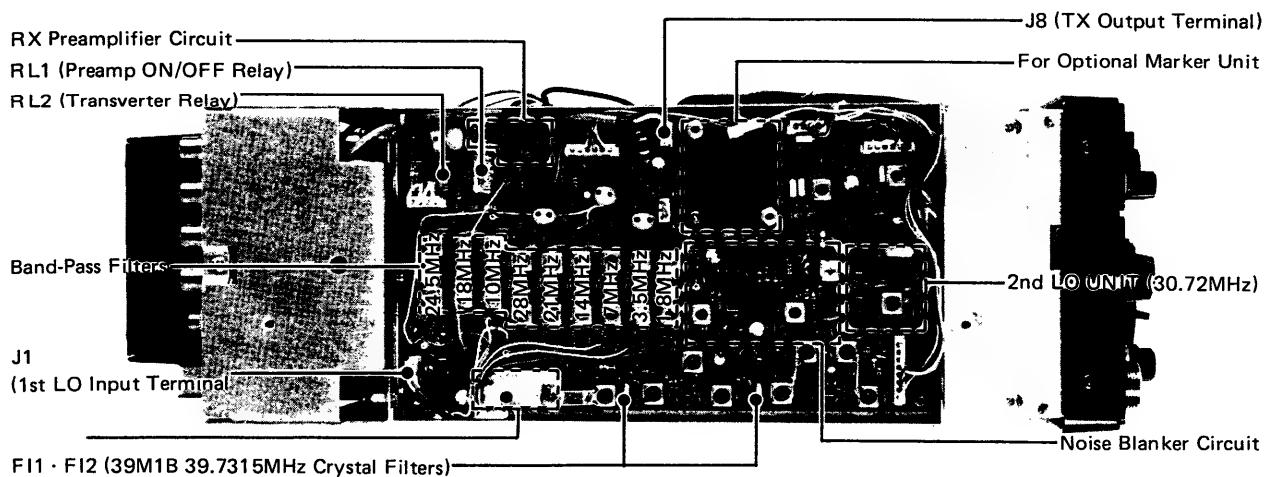
### 7-1 TOP VIEW



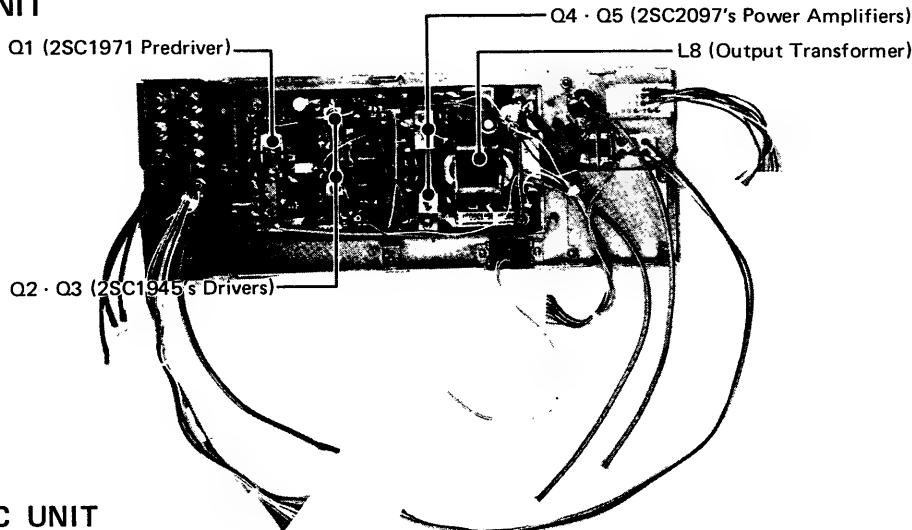
## 7-2 BOTTOM VIEW



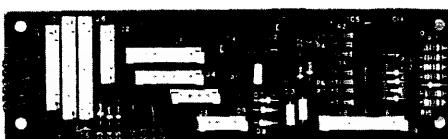
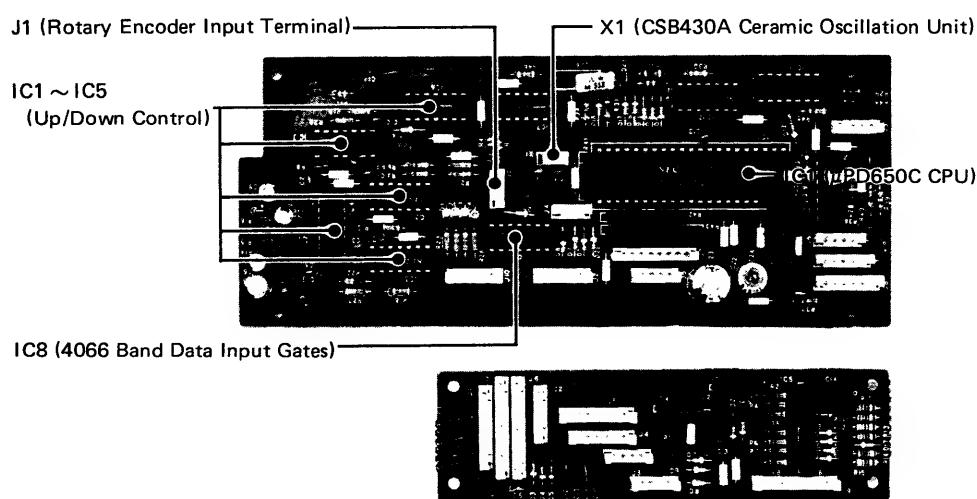
### 7 - 3 RF UNIT



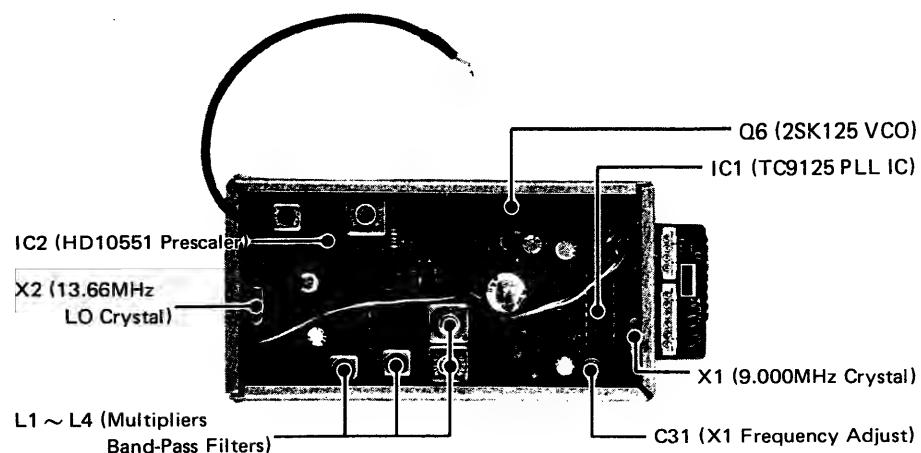
### 7 - 4 PA UNIT



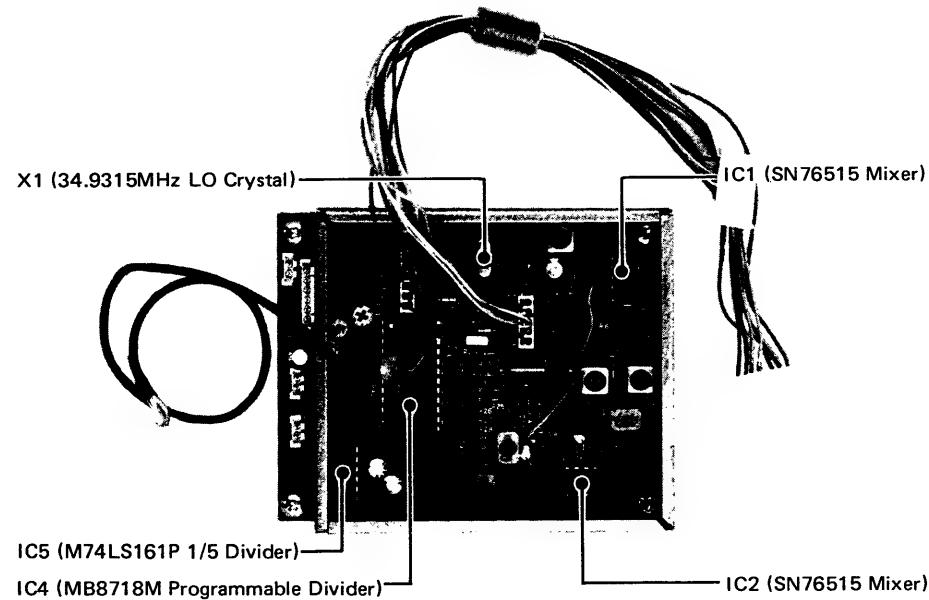
### 7 - 5 LOGIC UNIT



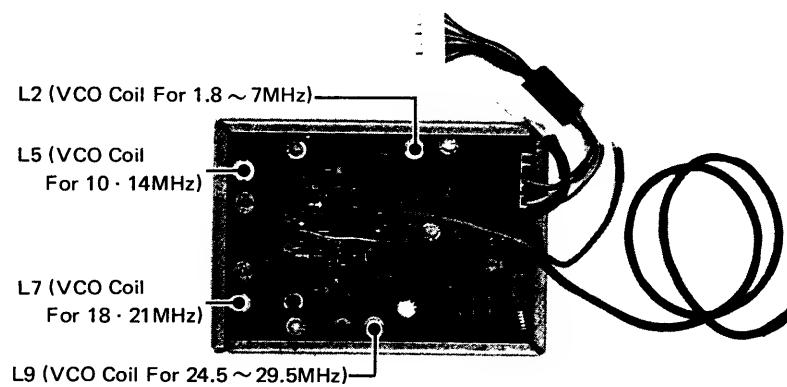
## 7 - 6 PLL UNIT



## 7 - 7 HPL UNIT



## 7 - 8 VCO UNIT



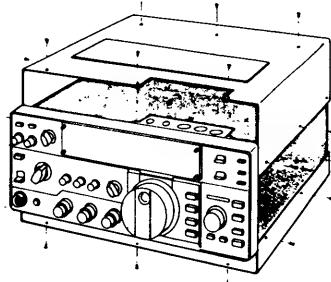
## SECTION 8 OPTION INSTALLATION

The following tools are needed for the installation of the options:

Phillips Screwdriver	Diagonal cutters
Screwdriver	Soldering Iron (40W)
Solder	Soldering tool
De-soldering braid	

Before performing any work on the set, make sure that the power cord is detached from the transceiver.

Remove the top and bottom covers by unscrewing the six screws each on the top and bottom, and the three screws on each side, while taking care not to damage the internal speaker, and unplug its connector.



### 8 - 1 INSTALLATION OF OPTIONAL FILTER

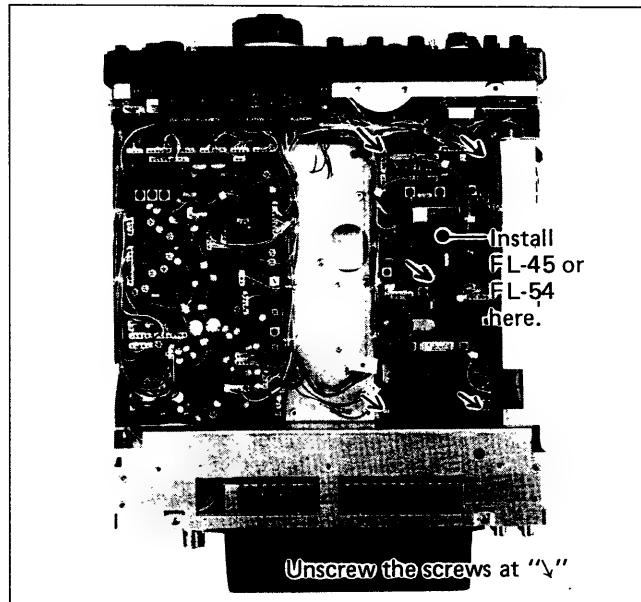
We have prepared various optional filters as follows.

	CENTER FREQUENCY	CHARACTERISTICS	USABLE MODE
FL-45	9.0115MHz	$\pm 250\text{Hz}/-6\text{dB}$ , $\pm 800\text{Hz}/-60\text{dB}$	CW·RTTY
FL-54	9.0115MHz	$\pm 135\text{Hz}/-6\text{dB}$ , $\pm 550\text{Hz}/-60\text{dB}$	CW
FL-44	455.KHz	$\pm 1.2\text{KHz}/-6\text{dB}$ , $\pm 2.1\text{KHz}/-60\text{dB}$	SSB
FL-52	455.KHz	$\pm 250\text{Hz}/-6\text{dB}$ , $\pm 500\text{Hz}/-60\text{dB}$	CW·RTTY
FL-53	455.KHz	$\pm 125\text{Hz}/-6\text{dB}$ , $\pm 240\text{Hz}/-60\text{dB}$	CW

#### 8 - 1 - 1 INSTALLATION OF FL-45/FL-54

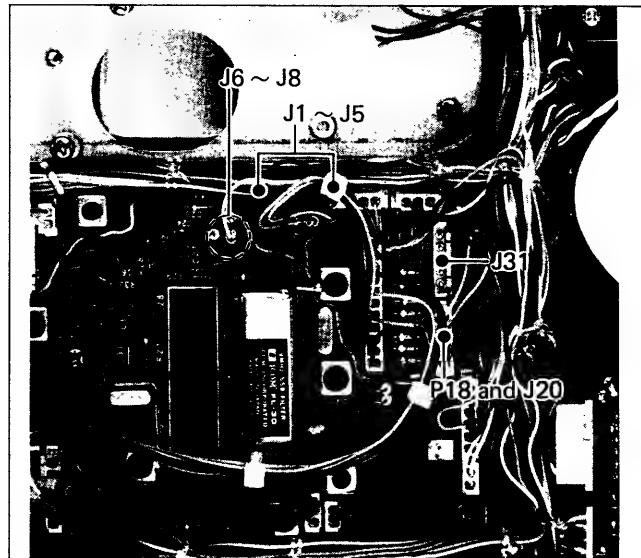
1. Unscrew the five screws retaining the IF unit board shown in the photo. Then turn the board over to the front side so that the foil side of the board can be seen.
2. The location for the filter is shown in the photo. The holes for mounting the legs and the leads of the filter are predrilled. Be sure to orient the filter so that the label on the top of the unit is facing the same direction as the other filter already mounted in the set. Insert the filter flush with the board, bend the leads and legs flush with the opposite side of the board and solder them in. Trim the leads even with the solder points. This completes the installation. Replace the IF Unit, and the screws.
3. When you would like to use the installed filter (FL-45 or FL-54) on the CW mode only, unplug P13 (BLUE wire) from J5, then plug it into J6 or J7.

In the CW mode, the installed filter is selected when the FILTER switch on the front panel is pushed in, and the filter gives 500Hz/-6dB or 250Hz/-6dB pass-band.



4. When you would like to use FL-45 on CW and RTTY modes (FL-45 cannot be used on RTTY mode, because its pass-band is too narrow for RTTY), unplug P18 (5 pins plug) from J20 and plug it into J31, and unplug P13 and plug it into J6 or J7 the same as (3).

In the CW and RTTY modes, the FL-45 is selected when the FILTER switch on the front panel is pushed in, and the filter gives 500Hz/-6dB pass-band for both the CW and RTTY modes.



NOTE: 1. The installed filter will function when the PBT switch on the front panel is pushed in.

2. When you have installed the FL-52 or FL-53 455KHz crystal filter and you would like to switch the 455KHz filter and the newly installed 9MHz filter by the FILTER switch, unplug P11 (GREEN wire), instead of P13, from J4 then plug it into J6 or J7.

The 455KHz filter is selected when the FILTER switch is pushed in and the 9MHz filter is selected when the FILTER switch is in the out position.

### 8 - 1 - 2 INSTALLATION OF FL-44

#### A. When replacing the original ceramic filter by FL-44

1. Unscrew the five screws retaining the IF unit board shown in the photo. Then turn the board over to the front side so that the foil side of the board can be seen.
2. Remove the solder from the ceramic filter sub-board on the IF unit board shown in the photo below, using a de-soldering braid, then remove the sub-board.
3. Insert the FL-44 to the position where the ceramic filter was installed (shown in the photo below) and retain it by using the two supplied nuts, then solder its terminal pins.
4. Replace the IF unit board, and top and bottom covers.
5. No adjustment is required for operation.



#### B. When installing FL-44 onto the position for an optional filter

1. Follow step 1 of the above instructions.
2. Insert the FL-44 to the position where is shown as "OPTION FILTER" for FL-52 and FL-53, and retain it by two supplied nuts then solder its terminal pins.
3. Unplug P4 (RED wire) from J23, then plug it into J28 or J29.  
Replace the IF unit board, and top and bottom covers.
4. In the SSB mode, the original ceramic filter and FL-44 can be selected by the FILTER switch on the front panel.  
When the FILTER switch is pushed in, the FL-44 is selected and gives its higher selectivity.

### 8 - 1 - 3 INSTALLATION OF FL-52/FL-53

1. Unscrew the five screws retaining the IF unit board shown in the photo. Then turn the board over to the front side so that the foil side of the board can be seen.

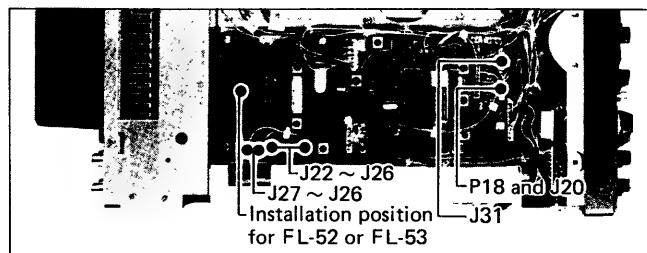
2. Insert the FL-52 or FL-53 to the position where is shown as "OPTION FILTER" for FL-52 and FL-53, and retain it by using the two supplied nuts then solder its terminal pins.

3. When you would like to use the installed filter (FL-52 or FL-53) in the CW mode only, unplug P12 (BLUE wire) from J26, then plug it into J28 or J29.

In the CW mode, the installed filter is selected when the FILTER switch on the front panel is pushed in, and the filter gives 500Hz/-6dB or 250Hz/-6dB pass-band.

4. When you would like to use FL-52 on CW and RTTY modes (FL-53 cannot be used on RTTY mode, because its pass-band is too narrow for RTTY), unplug P18 (5 pins plug) from J20 and plug it into J31, and unplug P12 from J26 and plug it into J28 or J29 the same as (3).

In the CW and RTTY modes, the FL-52 is selected when the FILTER switch on the front panel is pushed in, and the filter gives 500Hz/-6dB pass-band for both the CW and RTTY modes.

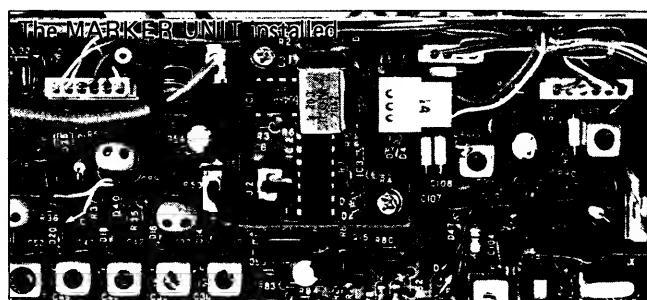


### 8 - 2 MARKER UNIT IC-EX241

This unit generates marker signals to calibrate IC-740's operation frequency. The marker generator puts out accurate 100KHz or 25KHz signals on the entire band, and gives easy and accurate frequency calibration.

#### 8 - 2 - 1 ASSEMBLY PROCEDURE

1. Install this unit in the position as shown in the photo on page 26, using the attached screws.
2. Plug P14 (3 pins) of the set to J1 of this unit.
3. Plug P1 (2 pins) of this unit to J9 of the RF unit.
4. Replace the speaker cord connector, and top and bottom covers.



### **8 - 2 - 2 CALIBRATION OF THE MARKER**

1. Set the MODE Switch in the CW position and BAND switch in the 10MHz position, then turn ON the POWER switch.
2. The FREQUENCY DISPLAY will show "10.100.0". Turn the TUNING CONTROL knob to tune to WWV (or other standard frequency station) on 10.000MHz, and a 800Hz beat tone will be heard. Set the TUNING RATE switch in 10Hz steps for fine tuning.
3. Set the MARKER Switch on the top cover in the "100K" or "25K" and adjust the MARKER CALIBRATION CONTROL on the top cover, so that the two tones are of the same pitch (in zero beat).

### **8 - 2 - 3 CALIBRATION OF THE TRANSCEIVER**

1. Set the MODE switch in the CW position and the TUNING RATE switch in 100Hz position. Tune to the lower band edge of the band you want to calibrate, as an example, "21.000.0".
2. Ground the KEY jack on the rear panel so that the CW sidetone becomes audible. (Don't transmit.)
3. Set the MARKER switch in the "100K" or "25K", and adjust the FREQUENCY SET CONTROL of the set so that the two tones are of the same pitch (in zero beat).
4. The frequency calibration is sufficient on a frequency on the same band, but it is required for each band.

### **8 - 3 FM UNIT IC-EX242**

This unit has a 9.0115MHz FM generator, 2nd IF amplifier, and FM detector circuits that will upgrade the IC-740 to a complete all-mode transceiver. The unit provides a clear, powerful FM signal, and interference-free steady reception for 29MHz FM and/or a VHF/UHF transverter.

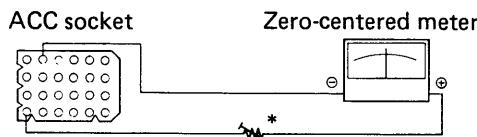
#### **8 - 3 - 1 ASSEMBLY PROCEDURE**

1. Install this unit into the position shown in the photo on page 24, using the attached screws.
2. Unplug P25 (2 pins with a coaxial cable) which is plugged into J16 of the IF unit, and then plug it into J4 to this unit.
3. Plug P26 (3 pins with a shielded wire and red wire) from the IF unit, into J1 of this unit.
4. Plug P28 (7 pins with white, gray, yellow, purple, red, black, and brown wires) from the front panel, into J2 of this unit.
5. Plug P29 (3 pins with brown, blue and yellow wires) from the front panel, into J3 of this unit.
6. Plug P1 (2 pins with a coaxial cable) of this unit, into J16 of the IF unit.

7. Plug P2 (3 pins with a coaxial cable and green wire) of this unit into J12 of the IF unit.
8. Plug P3 (2 pins with a shielded wire) of this unit, into J25 of the MAIN unit.
9. Replace the speaker cord connector, and top and bottom covers.
10. No adjustment is required, and the unit provides a complete FM operation.

### **8 - 3 - 2 OPERATION**

Refer to page 18 for the FM operations. When you would like to use a discriminator-meter, connect a zero-centered meter ( $\pm 50\mu A$  -  $10\mu A$ ) across Pin 1 and Pin 8 (ground) of the ACCESSORY socket on the rear panel of the set.



\* Insert a trimmer resistor if the meter swings too much.

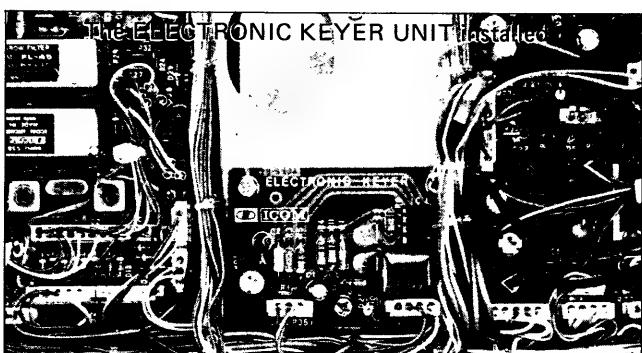
### **8 - 4 ELECTRONIC KEYER UNIT IC-EX243**

This unit provides automatic keying function with an iambic paddle. This unit is built with a single CMOS IC. Features designed into this IC include contact debouncing, RF immunity, self-completing character generation, dot memory and weight control.

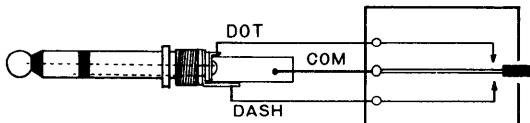
The keying speed can be changed between 5 - 45 wpm by the VOX GAIN/KEYER SPEED CONTROL on the front panel of the set.

#### **8 - 4 - 1 ASSEMBLY PROCEDURE**

1. Install this unit into the position shown in the photo on page 24 using the attached screws.
2. Plug P36 (3 pins) from the front panel, into J1 of this unit.
3. Plug P37 (4 pins) from the front panel, into J2 of this unit.



4. Connect an iambic paddle with a 3-p 1/4 inch key plug as shown in the following illustration.



5. Plug the key plug to the KEY JACK on the rear panel.
6. Check the operation of the keyer. If you would like to increase the weight (to alter the dot-space ratio), turn the weight control on this unit clockwise for your favorite position.
7. Replace the speaker cord connector, and top and bottom covers.

#### 8 - 4 - 2 OPERATION

Turn the VOX GAIN/KEYER SPEED CONTROL click on, and adjust keying speed by turning the control further clockwise for the most comfortable speed for you.

When you don't wish to use the keyer, turn the VOX GAIN/KEYER SPEED CONTROL completely counter-clockwise and click off. Then connect a hand key to the KEY JACK on the rear panel.

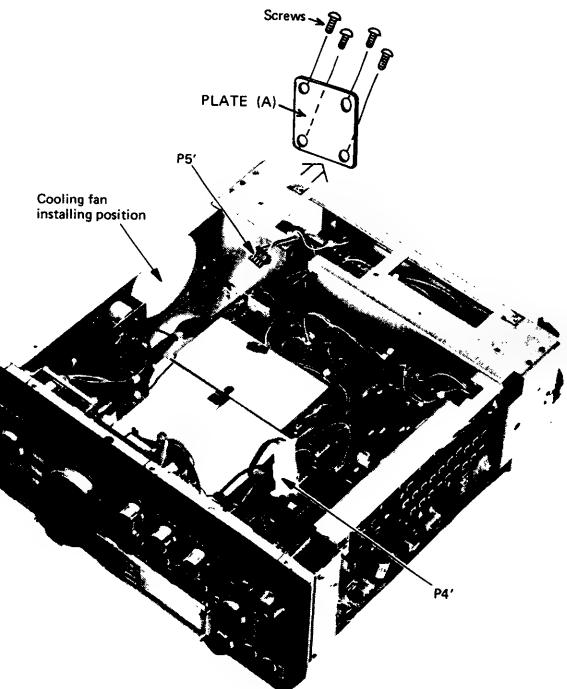
### 8 - 5 BUILT-IN POWER SUPPLY UNIT IC-PS740

#### 8 - 5 - 1 SPECIFICATIONS

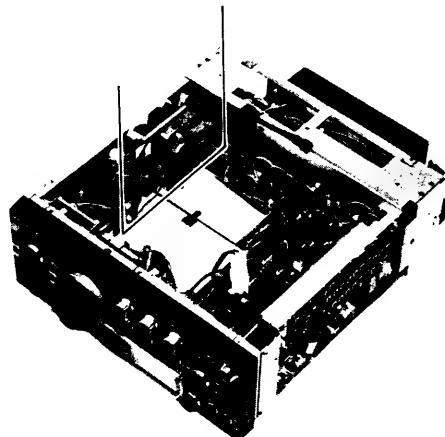
Number of Semiconductors	Transistor	5
	IC	2
	Diode	6
Input Voltage	110/220V AC (50/60Hz)	
Allowable Voltage Fluctuation	±10% of input voltage (suitable line voltage)	
Input Capacity	550VA (at 20A load)	
Output Voltage	13.8V DC Negative ground	
Max. Load Current	20A (10 mins ON/10 mins OFF)	
Dimentions	194(W) x 50(H) x 186(D) mm (excluding cooling fan)	
Weight	Approx. 2.5kg (including cooling fan)	
Kit Included	Main Unit	1
	Cooling Fan	1
	Power Socket Unit	1
	AC Power Cord	1
	Spare Fuse	2
	Installation Screws	10

#### 8 - 5 - 2 ASSEMBLY PROCEDURE

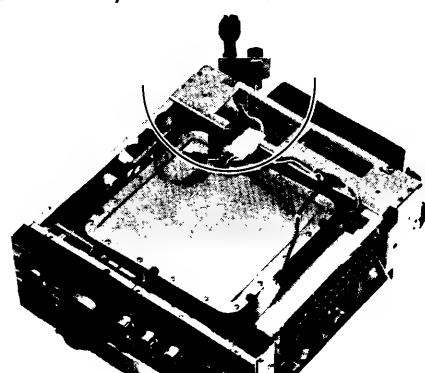
1. Turn the IC-740 upside down. Remove the "PLATE (A)" attached to the rear panel by unscrewing four screws. These screws will be used later.  
Unplug the connector P4' and leave the unplugged connector which is attached with wired from the rear panel to the space between the front panel and chassis.

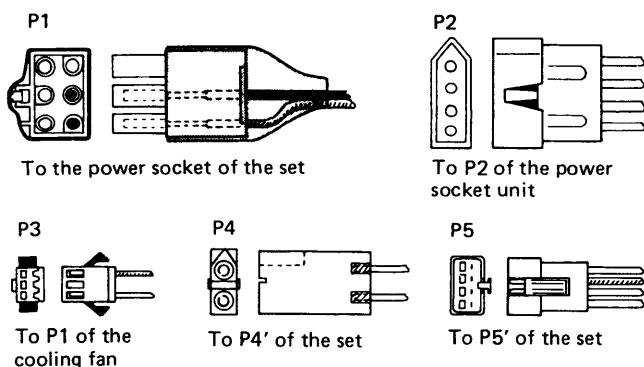


2. Place the cooling fan onto the installing position so that the motor coil is toward the rear as shown in the photo. Fix it with the four screws from the outer side of the chassis.



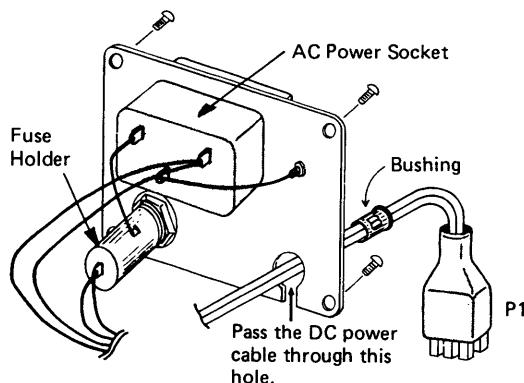
3. Put the power supply unit into the set so that its cables are toward the rear as shown in the photo. Connect the connectors with the appropriate one. Pass the DC power connector, P1, through the hole which was closed by the PLATE (A) before.





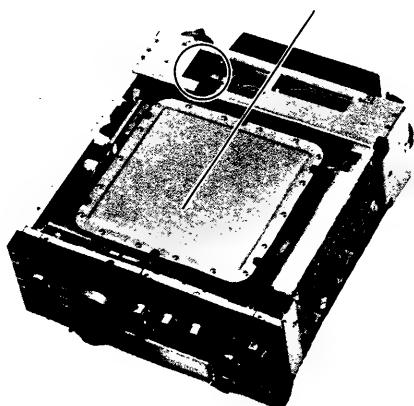
4. Pass the DC power cable attached to P1 through the hole of the AC power socket plate as shown in the illustration, then insert the bushing into the hole.

Attach the AC power socket plate to the position where the PLATE (A) was attached before, by using the screws described in 1, so that the AC power socket is toward the bottom of the set.



5. Put P2 and P5 into the space under the chassis (indicated by a circle in the photo), and other connectors into the space between the power supply unit and the chassis of the set.

Adjust the position of the power supply unit so that the center screw holes become centered with the center screw holes for the bottom cover.



6. Put the bottom cover of the set onto the power supply unit so that the screw holes of the bottom cover are fitted on the holes of the unit.

Then fix the power supply unit to the bottom cover with the supplied six screws.

7. Connect the internal speaker connector and replace the bottom and top covers of the set.

Plug P1 of the power supply unit to the DC Power Socket of the set.

#### 8 - 5 - 3 OPERATION

1. Connect the DC output plug, P1, of this unit into the transceiver DC Power Socket securely. At this time, make sure that:

- A. The power switch on the transceiver is OFF.
- B. The T/R switch is in the RECEIVE position.
- C. The PTT switch on the microphone is not depressed.
- D. The VOX switch is in the OFF (out) position.

2. Connect the supplied AC power cord into the AC power socket (newly installed) on the rear panel of the transceiver.

Then connect the AC power plug into an AC power outlet.

3. By turning the transceiver power switch ON, this unit will be turned ON and supply a 13.8V DC to the transceiver.

4. When the AC power plug is connected to an active AC line, the power to the CPU of the set is continuously supplied even when the power switch of the transceiver is turned OFF, to retain all the programmed frequencies in the memory channels, the operating frequencies of the VFO's, operating mode, etc.

#### 8 - 5 - 4 CAUTION

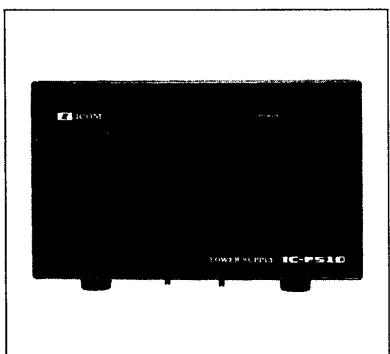
1. Ground the GROUND TERMINAL of the set with as short a wire as possible to prevent electrical shock, TVI, BCI and other problems.

2. This unit stops the output voltage with a protection circuit, when output voltage is shorted or consumed load current exceeds 25A. When the output voltage is stopped, turn the power switch of the transceiver OFF and remove the cause of the problem.

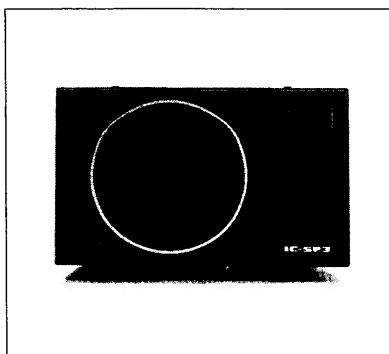
3. If the fuse blows, replace it with a 10A (at 117V) or 5A (at 240V) fuse after checking the cause of the problem. Use a Philips (+) screwdriver to open the holder. The outside ring of the holder cannot be rotated.

4. The optional IC-PS15 power supply however cannot be used with the IC-740 which has already had the IC-PS740 unit installed.

## 8 - 6 OTHER OPTIONS



**IC-PS15**  
AC POWER SUPPLY



**IC-SP3**  
EXTERNAL SPEAKER



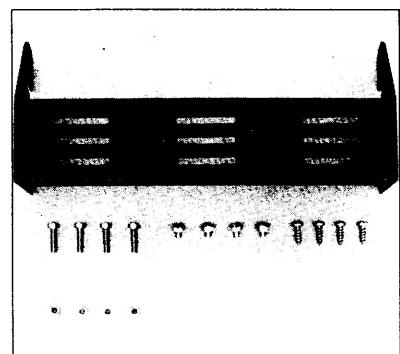
**IC-SM5**  
ELECTRET CONDENSER TYPE  
DESK MICROPHONE



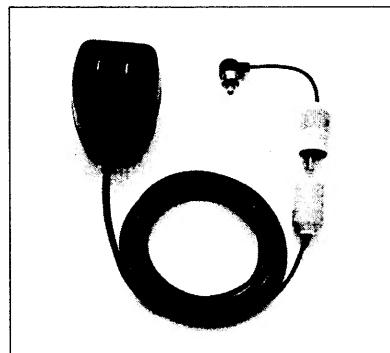
**IC-HM10**  
SCANNING MICROPHONE



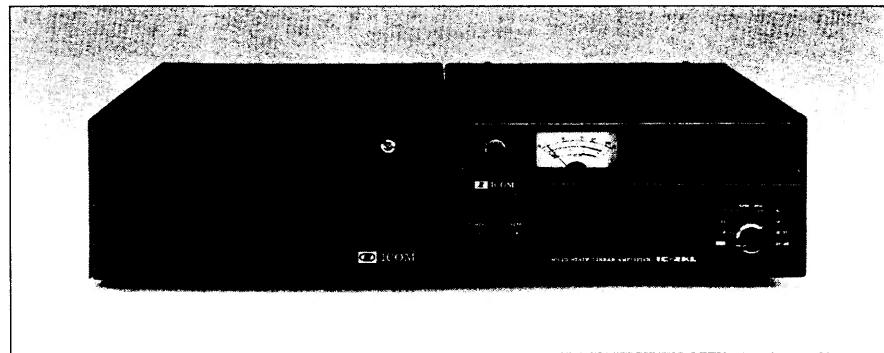
**IC-HP1**  
HEADPHONES



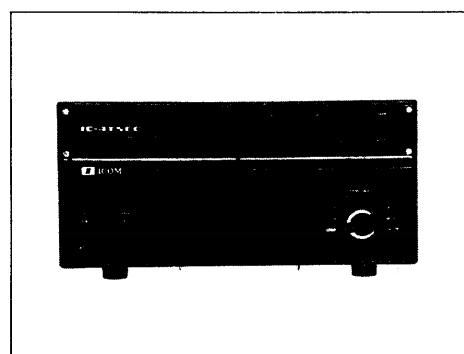
**IC-MB12**  
MOBILE MOUNTING  
BRACKET



**BC-10A**  
MEMORY BACKUP  
AC POWER SUPPLY



**IC-2KLPS**  
ATTENDANT POWER SUPPLY  
FOR IC-2KL



**IC-AT100**  
(100W)  
**IC-AT500**  
(500W)

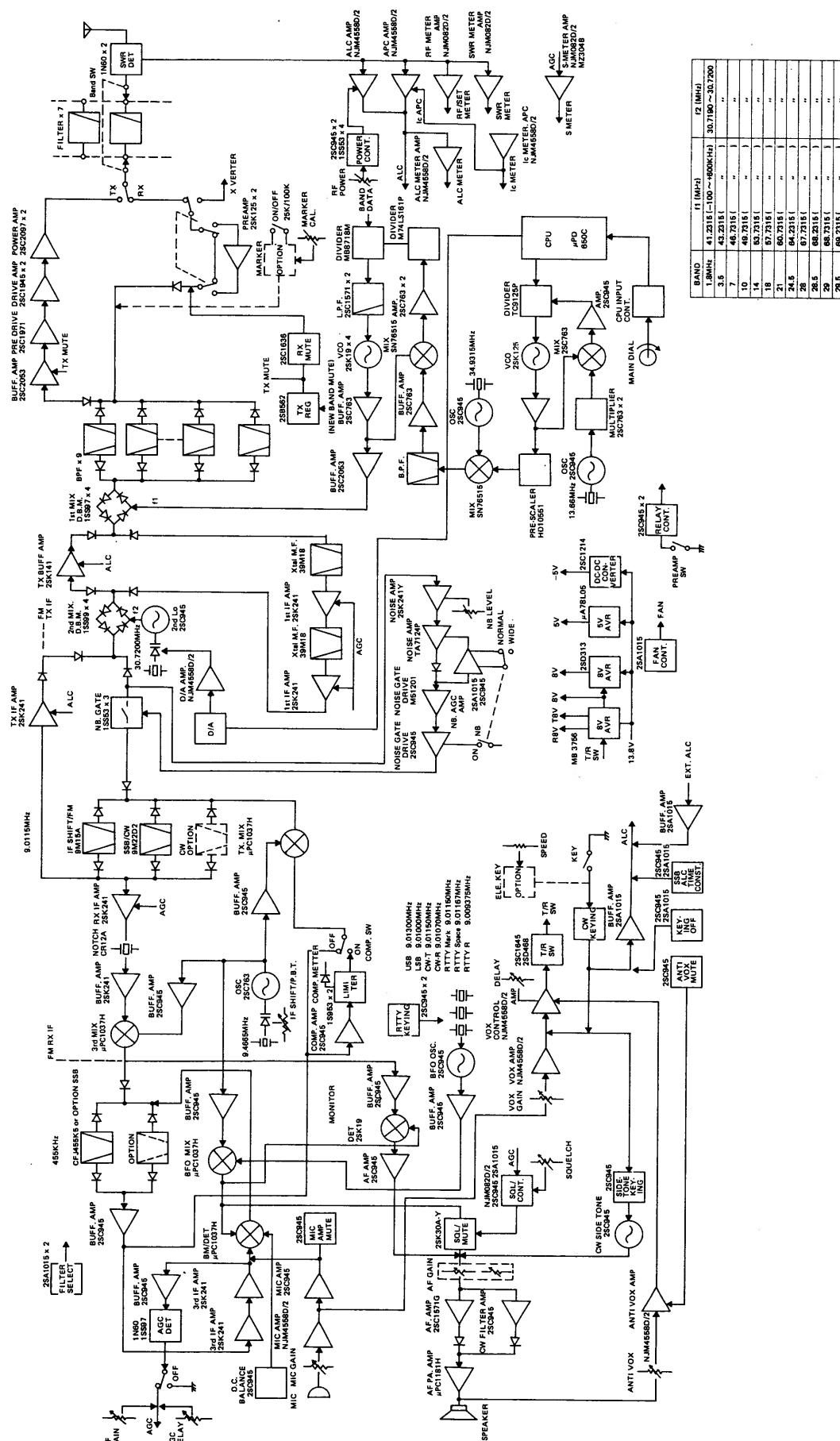
AUTOMATIC  
ANTENNA TUNER

## SECTION 9 TROUBLESHOOTING

Your IC-740 has been carefully adjusted at the factory prior to shipping. The chart below has been provided to help you correct problems which are not equipment malfunctions. If you are unable to locate the trouble, or correct the fault, please contact your dealer or the nearest ICOM Service Center.

Problem	Possible Cause	Solution
1. Power does not come on when the switch is pushed.	Power cable is improperly connected. Power cord is connected with the polarity reversed.  Blown fuse.	Carefully reconnect power cable. Disconnect the power cord, replace the blown fuse, then reconnect the power cord observing proper polarity.  Check for the cause, then replace the fuse with a spare one.  If using an IC-PS15, also check its fuse.
2. No sound comes from the speaker.	AF GAIN control knob is completely counterclockwise.  The unit is in the transmit mode, either by the T/R switch or the PTT switch on the microphone.  The external speaker cable is connected to the unit but not to the external speaker jack on the external speaker.  The internal speaker cable is not connected. A headphone is connected to the PHONES jack.	Turn the knob clockwise to a suitable level.  Put the unit in the receive mode.  Connect the cable to the speaker jack on the external speaker.  Connect the speaker connection. Unplug the headphone.
3. Sensitivity is low and only strong signals are audible.	RF GAIN control knob is turned counter-clockwise.  The antenna feed line is cut or shorted.	Turn the RF Gain control knob fully clockwise.  Check the feed line and correct any improper condition.
4. During receive, the "S" meter is higher than the "0" position even when there is no signal.	RF GAIN control knob is turned counter-clockwise.	Turn the knob fully clockwise.
5. Only incomprehensible voices are heard during SSB reception.	Receiving the wrong sideband.	Set the sideband opposite the one you are using, either USB or LSB.
6. The tone of the received signal is very high or low pitched.	Maladjustment of the P.B. Shift control.	Set the P.B. Shift control knob to the clear tone position.
7. No output power or low output power.	MIC GAIN setting is too low.  When SSB is desired, but the MODE is in the CW.  PTT switch is not functioning due to improper connection of the mic connector.  The antenna feed line is cut or shorted.	Turn the MIC GAIN control clockwise to the center (12 o'clock) position, or more.  Set the MODE to the SSB (USB or LSB).  Check the connection of the MIC connector and correct any problems.  Check the antenna feed line and correct any improper connection.
8. The receive mode functions properly and your signals are transmitted, but you are unable to make contact with another station.	The SPLIT switch is pushed in.  The receive frequency is offset from the transmit frequency by the Incremental Tuning control.	Set the SPLIT switch to the out position.  Turn OFF the RIT and/or XIT, or set the control knob to the center (12 o'clock) position.
9. The heatsink on the rear panel becomes hot.	The heatsink on the rear panel is for the final transistors and may become as hot as 40°C (104°F) above room temperature.	Make sure the area around the unit has as much ventilation as possible.
10. The frequency does not change by rotating the Tuning knob.	DIAL LOCK is engaged.	Disengage the DIAL LOCK by pressing and releasing the DIAL LOCK switch.
11. An abnormal figure is displayed on the frequency display or fails to illuminate.	The Power switch was turned OFF and ON too quickly.	Turn the Power switch OFF, wait 30 seconds, and then turn it ON again.
12. An unusual amount of distortion and/or noise in the transmit signal.	The MIC GAIN is too high when the Speech Processor is ON.	While watching the meter in the ALC mode, turn the MIC GAIN control counterclockwise so that the meter is within marked zone at the voice peak.
13. Unable to key when using an electronic keyer or hand key.	The Switching circuit of the external electronic keyer does not close completely.  Polarity of the connection wires from the keyer is reversed.  The MODE is not in the CW.  The VOX GAIN/KEYER SPEED control is not in the OFF position.	Replace the keyer with one having a voltage of less than 0.4V between the two keying lines at the key down condition, or modify your keyer so that the voltage is less than 0.4 Volts.  Connect the keyer wires observing proper polarity.  Place the MODE in the CW.  Place the control in the OFF position.

## SECTION 10 BLOCK DIAGRAM





**ICOM**

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